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Thomas Jefferson and science.[1]

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VIRGINIA IN JEFFERSON'S TIME

The career of every man is largely a product of his time and environment, of his birth, early surroundings, education, and associates, especially the associates of the formative period of his youth. No true appraisal of any man can be made without some knowledge of his background and of the influences that surrounded him, especially in his early years.

In Jefferson's time, Virginia had already acquired an enviable scientific tradition as a result of the work of Harriott, White, Hamor, Rolfe, the Claytons, Bannister, Mitchell, Glover, Catesby, Tennent, Carter, Lee, and others. Unfortunately the printed records do not give a complete picture of science in Virginia in the early colonial days, partly because of the scarcity and cost of paper, most of which was imported from Europe, chiefly from the continent. Nearly all the paper mills in America were situated in Pennsylvania and New Jersey, and their output was for local consumption.

In Jefferson's early days Virginia was to a considerable extent a feudal state, more or less on the English model, most of its best land being held by large landed proprietors. With the rapid opening up of the Piedmont, on which great estates worked by slave labor were not so practicable as they were on the flat and rich Coastal Plain, various social problems were beginning to arise. At the same time Virginia, now fairly well settled, was beginning to feel herself quite competent to manage her own affairs and was becoming restive under the domination of the English parliament, for she regarded herself as a sister rather than as a child of England.

Jefferson was a product of the Piedmont area, then almost a frontier region, and, though peculiarly fortunate in the circumstances of his birth and education, he did not view social conditions in the same light as did his aristocratic friends of the great estates on the rich and long settled Coastal Plain, with whom, however, he was always on the best of terms.

His sympathetic appreciation of the attitude both of the southern aristocracy and of those who, living in the wilder portions of the great new country, were trying to settle, cultivate, and organize the great wilderness, and his ability to harmonize their two viewpoints, can be really understood only in the light of his early environment and upbringing.

EARLY ENVIRONMENT, EDUCATION, AND ASSOCIATES

Peter Jefferson lived at Shadwell in Goochland, now Albemarle, County, Va., an unusually beautiful region of mountains, rolling hills, and river bottoms, its plant and bird life as diversified as its scenery, its lowlands with abundant relics of the former Indian inhabitants. He was a surveyor, and one of ability, for to him belongs the credit for preparing the first accurate map of Virginia, the so-called Jefferson and Fry map, published in London in 1775 under Jeffreys, the Royal Geographer. His wife was the former Jane Randolph, eldest surviving child of Isham Randolph of Dungeness, Goochland County, a well-known lover of plants, who corresponded with Peter Collinson in England and with other famous botanists of that time.

[1] Received April 16, 1943.

Their son Thomas had a great respect for his father's map, and from him, as suggested by Dumas Malone, he doubtless acquired much of his zest for exploration and drawing, and his liking for untrodden paths. From him, perhaps, he also acquired his fondness for mathematical subjects. From his mother's side he may have inherited that love of plants that throughout his life was so very characteristic of him, and his interest in birds.

On the death of his father in 1757 Thomas was placed under the guardianship of a neighbor, Thomas Walker, physician, soldier, and explorer, who had been with Braddock at Fort Duquesne in 1755 and who had traveled extensively in that vast area which at that time was included in western Virginia. According to Thomas P. Abernethy, Thomas Walker was typical of that company of bold spirits who explored and exploited the early frontiers—a man of action rather than of words.

In 1760 young Thomas entered the College of William and Mary, unusually well prepared by long attendence—since the age of five—at an excellent school, the so-called "English School," of which he personally had formed a poor opinion. At Williamsburg he found surroundings that for a keen young man with the widest possible interests were ideal. At that time the titular governor of Virginia was John Campbell, Earl of Loudoun, but the government was administered by the lieutenant governor, Col. Francis Fauquier, a true friend of Virginia and the Virginians, a devotee of the sciences who had been elected a Fellow of the Royal Society in 1753, and a director of the South Sea Company in 1751. With Colonel Fauquier there had come to Virginia in 1758 Dr. William Small, of Birmingham, who first held the chair of mathematics at William and Mary, and later that of philosophy, *ad interim*. These two delighted in the society of young men, and at Colonel Fauquier's table, where Dr. Small was a constant attendant, the youths of Virginia, Thomas Jefferson, John Page, John Walker, James McClurg, and others, "learned their lessons in the rights of men." In later years Jefferson referred to Dr. Small as the man who had fixed the destinies of his life, and John Page eulogized him as "the illustrious professor of mathematics . . . the darling friend of [Erasmus] Darwin." He might have added that he was also an intimate friend of James Watt.

At William and Mary, Jefferson and Page became fast friends, sharing their ideas and confidences. It was to Page that Jefferson wrote the letters that reveal his youthful romance with "the fair Belinda," who later married Jacquelin Ambler. The correspondence between Jefferson and Page covered 50 years without a trace of discord, and 30 years after their William and Mary days Jefferson declared to Albert Gallatin that he loved Page like a brother. In the election for governor of Virginia in 1779 Jefferson and Page were pitted against each other. Jefferson was denounced as a radical and Page as a tool of the Tories. The two candidates announced their platforms and retired to their estates, leaving the campaigning to their partisans. After the election, when Page sent congratulations to his victorious opponent, Jefferson replied that he derived special satisfaction from the fact "that the difference of the numbers which decided between us, was too insignificant to give you a pain, or me a pleasure, had our dispositions towards each other been such as to admit those sensations." Page, who was lieutenant governor under Patrick Henry and later (1802–5) governor, spent much of his time in scientific investigations. With his friend David Jameson he was interested in astronomy and made experiments in the accurate measurements of the fall of rain and dew. He also suggested, as early as 1779, the identity of magnetism and electricity. For a time he was president of the Virginia Society for the Promotion of Useful Knowledge, at Williamsburg, a group that sought to play in Virginia the role of the Royal Society in London. In later years he confessed that he did not think he had made great proficiency in any study, for he was too sociable to shut himself off in solitude as did his friend Jefferson.

John Walker was a son of Thomas Jefferson's guardian, Thomas Walker. He subsequently served on the staff of General

Washington as an extra aid with the rank of colonel, and also served in the United States Senate, by appointment from the Governor of Virginia, to fill the vacancy caused by the death of William Grayson. He was elected a member of the American Philosophical Society in 1770.

James McClurg was a more serious student than either Jefferson, Page, or Walker. After graduating from William and Mary he attended the medical school at the University of Edinburgh, from which he graduated as a Doctor of Medicine in 1770. While there he was a prominent member of the Virginia Club, an organization composed of Virginians studying at the school. After graduation he devoted some time to postgraduate medical studies in Paris and London, returning to Virginia in 1773. During the Revolution he was active as a surgeon in the Virginia militia, being referred to in the official records as physician-general and director of hospitals for the State. He was professor of anatomy and medicine at William and Mary from 1779 to 1783, after that living in Richmond. He was elected a member of the American Philosophical Society in 1774, and was also a member of the Virginia Society for the Promotion of Useful Knowledge. He was a member of the Philadelphia Convention, and later of the Executive Council for Virginia during the early years of Washington's administration. He was regarded as one of the most eminent physicians in the State and was president of the State medical society in 1820 and 1821. The first volume of the *Philadelphia Journal of Medical and Physical Sciences* published in 1820 was dedicated to him. According to James Madison. Dr. McClurg's talents were of the highest order, but he was modest and unaccustomed to exert them. Possibly his interest in his profession precluded any pronounced ambition toward a political career. Jefferson maintained a close friendship for McClurg, for whom he seems to have had great respect.

Such were the favored associates of young Jefferson at William and Mary, mature men of exceptional ability, sympathetic with, and fond of, the young, and young men of unusual promise. He graduated in 1762 at the age of 19 with a reasonably thorough reading knowledge of Latin, Greek, and French, and a familiarity with the higher mathematics and with the physical sciences rarely possessed by young men of his age. Fortune favored him still further, for after graduation he entered the law offices of George Wythe, then the leader of the Virginia bar, whom he described as "the best Latin and Greek scholar in the State," and as a "faithful and beloved mentor in youth and most affectionate friend through life."

He was admitted to the bar in 1767 after five years of study. After his admission to the bar he practiced law with more than usual success, and was elected to the House of Burgesses in May, 1769, and appointed surveyor of the County of Albemarle in 1773. From this time on he became more and more intensively interested in politics; though his interest in science never diminished, he was seldom able to devote much time to it.

PERSONALITY

At the time of his admission to the bar he was described as 6 feet 2 inches tall, slim, erect as an arrow, with angular features, a very ruddy freckled complexion, an extremely delicate skin, full deep-set hazel eyes, and sandy hair. Known to his friends as "Long Tom," he was a gay companion, an expert musician, the violin being his favorite instrument, a good dancer, a dashing rider, and proficient in all manly exercises. He was then, and continued to be throughout his life, frank, earnest, cordial, and sympathetic in his manner, full of confidence in men, and sanguine in his views of life. He seems to have been a recognized member of the closely knit social group made up of the children of the great families of Virginia.

As a mature man he had by nature a scientific mind, and he once remarked that "the tranquil pursuit of science" was his "supreme delight." He also wrote that he was "for encouraging the progress of science in all its branches, and not for raising a hue and cry against the sacred name of philosophy." He regarded "freedom and science"

as the prerequisites of progress, and said that he had "sworn upon the altar of God eternal hostility against every form of tyranny over the mind of man."

His legal training made him cautious in drawing conclusions from a series of isolated facts, and therefore impatient of all theories not logically deduced from adequate premises. In a letter to Charles Thompson written from Paris on September 20, 1787, he said "I wish that the persons who go thither [to the western country] would make very exact descriptions of what they see of that kind [*i.e.*, fossil bones], without forming any theories. The moment a person forms a theory, his imagination sees, in every object, only the traits which favor that theory. But it is too early to form theories on these antiquities. We must wait with patience until more facts are collected."

He was essentially of a reflective type, and it was his habit to seclude himself from time to time, while he diligently studied some branch of science as a relief from the grim realities of political and other worries. This habit of letting his mind lie fallow, so to speak, and thus to clear itself of unimportant details, probably had much to do with the brilliant manner in which he viewed all subjects in the light of their essential features, without being led astray by superficial emotional aspects.

In everything he did his custom was to sow the seed carefully, nurse it for a while, and then, when its successful growth seemed assured, turn it over to others for its further development and ultimate fruition, usually under his stimulation and guidance. In science, as in everything else, he followed this line. And so it happens that, judged from the record, his main scientific interests were in those lines that were most backward and in which vigorous and intelligent leadership was most needed, especially those lines that would ultimately prove of greatest value to the people.

Perhaps the most remarkable and outstanding feature of Jefferson's character was his complete freedom from personal jealousy. Freedom of thought was no mere political phrase with him. Everyone, according to him, was entitled to his own ideas. Naturally, he differed with many people, but these differences he never took personally. A good illustration of this is seen in his attitude toward the contest between himself and John Page for the governorship of Virginia. He had an immense number of loyal friends, many of whom disagreed with his political outlook, though they never distrusted his sincerity. Dr. George Gaylord Simpson rightly says that "it is a measure of his greatness that Jefferson continued his powerful aid to paleontology and his warm friendship with its students even when it became evident that this aid and these students were revealing the falsity of views that he had vehemently and almost religiously expressed and maintained during the greater part of a long life."

JEFFERSON'S SCIENTIFIC INTERESTS

As a scientific man Jefferson was interested in all lines of science, but in all rather as an enthusiastic, highly appreciative, and intelligent amateur than as a professional. He had no time to make himself thoroughly proficient in any one line. The working out of the details he left to others, whom he assisted and encouraged to the best of his ability. His tremendous enthusiasm, which continued unabated, or perhaps even increased, during his term of office as President of the United States, was a most important factor in bringing before the people the value of science.

Tangible evidence of Jefferson's many and varied scientific interests is furnished by his contributions to the proceedings and collections of the American Philosophical Society in Philadelphia, of which he was elected a member, together with George Washington, in 1786, after the death of David Rittenhouse succeeding him as the third president of the Society on January 6, 1797. His contributions to the Society's program and collections were in the fields of meteorology, chemistry, economic entomology, archeology, vertebrate paleontology, and applied mechanics in reference to agricultural operations.

On December 17, 1779, there was recorded in the Society's proceedings a letter

from Rev'd Wm. Maddison (*sic*), president of William and Mary College, containing "a series of Meteorological Observations by His Excellency Governor Jefferson and himself separately, for a year and a half; likewise a set of Experiments on what are called 'Sweet Springs'." On April 15, 1791, on motion of Jefferson, a select committee (consisting of Jefferson and four others) was appointed to collect materials for forming the natural history of the Hessian fly and determining the best means for its prevention or destruction "and whatever else relative to the same may be interesting to agriculture." On August 19, 1791, he presented to the Society "a curious piece of Indian sculpture, supposed to represent an Indian woman in labor, found near Cumberland River, Virginia." On August 19, 1796, his letter to Rittenhouse (deceased) describing bones of extraordinary size found beyond the Blue Mountains in Virginia [in a cave in Greenbrier County, W. Va.] "appearing to be of the Tyger-lion & Panther species" was read by Dr. Barton. Under date of March 10, 1797, we read: "Jefferson's memoire 'On the Discovery of certain Bones of a Quadruped of the [space of four lines left blank].' A resolution was passed ordering the memoir to be put in the hands of the Committee of Selection of Publications, drawings of the bones to be made by a proper person. Mr. Peale was requested to put the bones 'in the best order for the Society's use'." These were the bones of the famous *Megalonyx*, the first giant sloth found in North America, and formed the subject of the only scientific memoir ever published by Jefferson, which appeared in 1799. On January 19, 1798, he presented to the Society bones of a mammoth "some time ago found in Virginia." On April 20, 1798, he presented a hand threshing machine invented by T. C. Martin of Virginia, "which he had procured to be made." On May 4, 1798, a "Description of a Mould Board of the least resistance, &c.," by Mr. Jefferson was read and referred to Mr. Patterson. This is the first mention of his famous plow. On May 7, 1804, W. Lewis, of Campbell County, Va., donated a bone and some rocks through Jefferson. On April 27, 1805, William Bartram sent some bones to be forwarded to [Jefferson at] Monticello.

Much more detailed evidence of his extensive interests is furnished by his famous book on Virginia. In June, 1781, he was injured by a fall from his horse, and he occupied the leisure forced upon him by this accident in organizing the abundant and accurate memoranda that he had accumulated over a series of years. These memoranda were arranged in the order of a series of questions that had been submitted to him by M. Barbé de Marbois, Secretary of the French Legation. During the winter of 1782–83 he revised and expanded them and had them published in Paris in 1784 under the title of "Notes on the State of Virginia." The date of this work is given as 1782, which is probably the date of the completion of the manuscript, as he did not reach Paris until 1784. Two hundred copies were privately printed, as the work was not intended for general distribution. According to Sabin, a copy presented to M. Malherbe has the following note in Jefferson's hand writing: "Mr. Jefferson having had a few copies of these notes printed to present to some of his friends, and to some estimable characters beyond that line, takes the liberty of presenting a copy to M. de Malherbe, as a testimony to his respect to his character. Unwilling to expose them to the public eye, he begs the favour of M. de M. to put them into the hands of no person on whose care and fidelity he cannot rely, to guard them against publication."

This work, however, did not long remain confidential. A French translation, with a map, entitled "Observations sur la Virginie, par M. J***. Traduit de l'Anglais," was published in Paris in 1786, and an English reprint of the original was published in London in 1788. The first American edition was published in Philadelphia in 1788. In the *Virginia Independent Chronicle* (Richmond) for Wednesday, December 12, 1787, we read that "the work will be comprised in a handsome octavo volume, with an elegant type and good paper, and delivered to the subscribers neatly bound and lettered at the very moderate price of one dollar.

The price to non-subscribers will be seven shillings and six pence Virginia currency . . . Subscriptions are taken in at Mr. Davis's Printing-Office in Richmond, where a specimen of the work is left for inspection." A second edition was printed in Philadelphia in the same year. This was followed by many other American editions —Philadelphia, 1792, 1794, 1801, 1812, 1815, 1825; Baltimore, 1800 (two editions); New York, 1801, 1804; Newark, 1801; Boston, 1801, 1829, 1832; Trenton, 1803, 1812; and Richmond, 1853. There was also a German translation entitled "Beschreibung von Virginien," published at Leipzig in 1789.

This was the first comprehensive treatise to be published on any section of the United States. In it were discussed the boundaries of the State, the rivers, the seaports, the mountains, the cascades, the mineral, vegetable, and animal productions, climate, population, military force, marine force, aborigines, etc. It was the precursor of that great library of more or less similar reports that have been issued by the State and Federal Governments. Measured by its influence, it was the most important scientific work published in America up to this time. It laid the foundation for Jefferson's high contemporary reputation as a universal scholar, and for his enduring fame as a pioneer American scientific man.

Further evidence of his interests is given by various printed reports, such as his report of July 4, 1790, presented to Congress on July 13, in which he made suggestions regarding a plan for establishing uniformity in the coinage and in the weights and measures of the United States, the first suggestion of the idea that was subsequently expanded into the National Bureau of Standards, and his scholarly report on the history and economics of the cod and whale fisheries made to the House of Representatives on February 1, 1791, and published on January 8, 1872.

Then there are the manuscript notes left by him, among which are the extensive meteorological records kept at Monticello, his notices of the first appearance of the birds and flowers in spring, and his comparative notes on Indian languages.

But by far the greater part of what we know regarding Jefferson's scientific interests is gathered from the great number of letters that he wrote to various friends and that were published after his death.

Applied science appealed to him quite as much as pure science. He was much interested in horticulture and in every form of agriculture. Botany was always a favorite subject with him, and he had one of the best botanical libraries in America, though on this he never published anything further than the lists of plants in his "Notes on the State of Virginia," which includes the first description of the pecan, written in 1781 or 1782.

Jefferson was an inventor of great ingenuity, as is made evident at once by a visit to his home at Monticello. He also had a keen interest in the inventions of others, especially those of practical application. When he was in France he wrote dozens of letters about inventions. When on a visit to England in 1786 he made careful notes on English domestic gardening and on mechanical appliances. He went to northern Italy in 1787 to inspect machines for cleaning rice, and in 1788 he made other observations in Germany. At the time of the creation of the Patent Office, Jefferson was Secretary of State. As such, he became *ex officio* the Keeper of the Records of the Patents, and according to Dr. Frederick E. Brasch was the most active examining member of the board, and therefore its first administrator. Dr. Brasch says that the scientific foresight that he exercised at this time must be considered the cornerstone of our patent system and patent laws.

SPECIAL SCIENTIFIC INTERESTS

Jefferson's keen interest in inventions more than anything else gives the key to his interest in science in general, which was the ultimate practical application of scientific discoveries for the good of man. No matter what line of scientific investigation he undertook, this idea of ultimate practical application seems always to have been in his mind. He seems never to have followed any line through mere pointless curiosity. Even in his study of fossils he appears to have had the idea that some time, somehow, a

knowledge of them would prove of value.

Of his numerous and varied scientific interests, three deserve special mention. First and foremost was his interest in man in general, evidenced not only by his political philosophy but also by his detailed study of the native Indians and his efforts to improve their relations with the Europeans, and by his sympathetic study of the Negroes; second was his interest in the exploration and description of the country; and third was his interest in paleontology.

The French historian and philosopher Guillaume Thomas François Raynal, usually called the Abbé Raynal, a leader of the French freethinkers who was exiled from France in 1781, had maintained, among other things, that Europeans had degenerated in America, and that the American Indians were a degenerate race. Jefferson denied this, and he also denied that the American Indians are inferior to Europeans in the same state of culture. He also said he has supposed that the black man, in his present state, might not be equal to the European, "but it would be hazardous to affirm that, equally cultivated for a few generations, he would not become so." In his "Notes on the State of Virginia" he gave an excellent account of the Indians and described the "barrows of which many are to be found all over in this country," listing the contents of one in the Rivanna River bottom. He also described the characteristics of the Negroes in dispassionate detail.

He was greatly interested in the multiplicity of radically different Indian languages and contrasted this with the lack of diversification among the red men of eastern Asia. He said that "the resemblance between the Indians of America and the eastern inhabitants of Asia, would induce us to conjecture, that the former are the descendants of the latter, or the latter of the former; excepting, indeed, the Eskimaux, who, from the same circumstances of resemblance, must be derived from the Greenlanders, and thus probably from some of the northern parts of the old continent."

In his "Notes on the State of Virginia" he wrote: "Were vocabularies formed of all the languages spoken in North and South America, preserving their appellations of the most common objects in nature, of those which must be present to every nation, barbarians or civilized, with the inflections of their names and verbs, their principles of regimen and concord, and these deposited in all the public libraries, it would furnish opportunities to those skilled in the languages of the old world to compare them with the new, now or at any future time, and hence to construct the best evidence of the derivation of this part of the human race." He compiled comparative vocabularies of various Indian tribes, which were unfortunately stolen; but some fragments of these are deposited in the American Philosophical Society's archives.

Dr. Clark Wissler has pointed out that at about the same time the Empress Catharine the Great of Russia had adopted the same approach to the study of languages and had written to President Washington for lists of Indian vocabularies.

Jefferson's practical and sympathetic interest in the Indians is perhaps best illustrated by the instructions given by him to Capt. Meriwether Lewis in 1803 when the Lewis and Clark Expedition was about to be organized. These were as follows: "The commerce which may be carried on with the people inhabiting the lines you will pursue renders a knowledge of these people important. You will therefore endeavour to make yourself acquainted, as far as a diligent pursuit of your journey shall admit, with the names of the natives and their numbers; the extent and limits of their possessions; their relations with other tribes or nations; their language, traditions, monuments; their ordinary occupations in agriculture, fishing, hunting, war, arts, and the implements for these; their food, clothing, and domestic accommodations; the diseases prevalent among them, and the remedies they use; moral and physical circumstances which distinguish them from the tribes we know; peculiarities in their laws, customs, and dispositions; and articles of commerce they may need or furnish, and to what extent. And considering the interest which every nation has in extending and strengthening the authority of reason and justice among the people around them, it will be useful to acquire what knowledge you can

of the state of morality, religion, and information among them, as it may better enable those who may endeavour to civilize and instruct them to adapt their measures to the existing notions and practices of those on whom they are to operate . . .

"In all your intercourse with the natives, treat them in the most friendly and conciliatory manner which their own conduct will admit; allay all jealousies as to the object of your journey; satisfy them of its innocence; make them acquainted with the position, extent, character, peaceable and commercial dispositions of the United States, of our wish to be neighbourly, friendly and useful to them, and of our dispositions to a commercial intercourse with them; confer with them on the points most convenient as mutual emporiums, and the articles of most desirable interchange for them and us. If a few of their influential chiefs, within practicable distance, wish to visit us, arrange such a visit with them, and furnish them with authority to call on our officers on their entering the United States, to have them conveyed to this place at the public expense. If any of them should wish to have some of their young people brought up with us, and taught such arts as may be useful to them, we will receive, instruct, and take care of them. Such a mission, whether of influential chiefs or of young people, would give some security to your own party. Carry with you some matter of the kine-pox, inform those of them with whom you may be of its efficiency as a preservation from the small-pox and instruct and encourage them in the use of it. This may be especially done wherever you winter."

Dr. O. F. Cook wrote that the traditional sponsors of the repatriation and colonization of the Negroes in west Africa were Thomas Jefferson and George Washington. Jefferson studied the racial problem from many sides, including the need of educating the more capable Negroes so that they might furnish the necessary skill and leadership for the new communities in Africa. Washington instructed his executors to provide such education for some of his freedmen.

Almost immediately after his inauguration as the third President of the United States Jefferson began to make preparations for developing his long-cherished plans for the exploration of the great and unknown West and the discovery and description of its vast resources. His secretary, Capt. Meriwether Lewis, of Albemarle County, Va., who had long wished to go on an exploring expedition, was appointed leader of the first party to be sent out—partly at Jefferson's personal expense. Captain Lewis chose as his chief associate Capt. William Clark, also of Albemarle County, a younger brother of Gen. George Rogers Clark. The choice of these two leaders was a most fortunate one, and the expedition, which was in the field from 1803 (the year in which the territory extending from New Orleans to British America and westward to the Rocky Mountains known as Louisiana was purchased from Napoleon) until 1806 was highly successful. This was the first of a long series of more or less similar expeditions by which a detailed knowledge of our great West and of its resources and products was gradually accumulated. These expeditions, at first individual enterprises, were later consolidated under the United States Geological Survey.

Jefferson's interest in exploration was not confined to the land areas. Dr. Brasch writes that in 1806 he made a recommendation for a Coast Survey to Congress, which took favorable action on February 10, 1807, and authorized the President to cause a survey to be made of the coasts of the United States, including islands, shoals, and all other physical features deemed proper for completing an accurate chart of every part of the coast. This project was later organized as the United States Coast (now Coast and Geodetic) Survey. Dr. Brasch adds that during Jefferson's second term the idea of establishing longitude 0° through Washington (77°03′58″ west of Greenwich, England) was much discussed. Jefferson's thorough knowledge of astronomy and mathematics, together with navigation, enabled him to give much encouragement to members of Congress who wished to establish this standard American longitude. This discussion, according to Dr.

Brasch, eventually led to the establishment of the Naval Observatory and the Hydrographic Office.

Enthusiasm for vertebrate paleontology seems to have been awakened in Jefferson before 1781, after which time he lost no opportunity for securing and examining bones. He was always especially interested in the mastodons, or "mammoths," and in the great sloth that he had called *Megalonyx*. As in other branches of science, his interest in paleontology was chiefly that of an enthusiastic amateur, and a stimulator of interest in others. Dr. Henry Fairfield Osborn has pointed out that in developing his scientific opinions in regard to paleontology he at first quoted the current tradition, later becoming a more serious and independent investigator.

The Lewis and Clark Expedition had brought back a few interesting fossils, which had whetted Jefferson's desire for more. In the summer of 1807 Captain Clark was sent on another expedition to Louisiana that took him through the region of Big Bone Lick, in Boone County, Ky. In obedience to President Jefferson's desires he stopped there and, employing ten laborers for several weeks, made a large collection of about 300 bones, which he shipped to Jefferson at the White House. Here they were laid out in the then unfinished East Room, the "mastodon room," where, at Jefferson's invitation, and later at Philadelphia, they were examined by Dr. Caspar Wistar.

Jefferson's interest in paleontology while President, as remarked by Dr. George Gaylord Simpson, helped to make it a respectable and honored pursuit, and he was largely responsible for bringing together the materials necessary for its advancement. He greatly encouraged the study of vertebrate paleontology by the American Philosophical Society while he was president of it. He also acted for a time as president of the board of trustees of Peale's Philadelphia Museum, which included the first public exhibition of fossil vertebrates, and the first mounted fossil skeleton in America. As the foremost citizen of the young nation, Jefferson's outspoken and excited interest in fossils conferred on their study the dignity and prestige inseparable from his personality and position. But it also brought down upon him the ridicule and wrath of many of his countrymen to whom scientific investigation meant wanton and deliberate neglect of one's proper duties, if not, indeed, atheism. This attitude is well illustrated by a poem written by William Cullen Bryant at the age of 13, which runs in part as follows:

> Go, wretch, resign thy presidential chair,
> Disclose thy secret measures, foul or fair,
> Go, search with curious eyes for hornéd frogs,
> 'Mid the wild wastes of Louisianian bogs;
> Or where the Ohio rolls his turbid stream
> Dig for huge bones, thy glory and thy theme.

It is only fair to Bryant to say that this poem, entitled "The Embargo," was published not by himself but by his father, Dr. Peter Bryant, and that he did his best to suppress it.

JEFFERSON AND HIS VIRGINIAN COLLEAGUES

It must not be supposed that during his brilliant and eventful career Jefferson was neglectful of his scientific colleagues in his native State of Virginia. Before the American Philosophical Society had elected more than a very few members from Virginia there was organized at Williamsburg on November 20, 1773, "The Virginia Society for the Promotion of Useful Knowledge." The charter was signed by six prominent Virginians, including the Hon. John Page, then lieutenant governor, who was elected vice-president, the president being John Clayton. Of the six who signed the constitution, John Walker was already a member of the American Philosophical Society, which James McClurg joined in the following year, and Mann Page later.

The notices regarding the activities of this Society were published in the *Virginia Gazette* at Williamsburg. There is no reference to Jefferson in any of them, but he was presumably a member, for in a letter written in 1787 in answer to one from John Page, who had urged him to accept the presidency, he wrote that "he should feel himself out of his true place to stand before McClurg," who was probably president at the time.

In its early years the society seems to

have been well received by the people of the colony; but after 1774 there are few published notices of it, although it appears to have kept up an organization for a considerable time.

JEFFERSON IN FRANCE

Jefferson was in France from August 6, 1784, to October, 1789, succeeding Benjamin Franklin as Minister in 1785. Dumas Malone writes that, rightly regarded in France as a savant, he carried on the tradition of Franklin, but until the end of his stay he was overshadowed by Franklin's immense reputation. His attitude toward Franklin, whom he regarded as the greatest American, was one of becoming modesty, without a tinge of jealousy.

At that time France was regarded as the leader in the biological sciences; but Jefferson thought little of French science. He vigorously combated what he considered the disparagement of the American fauna by Georges Louis Leclerc, Comte de Buffon, who maintained that the animals common to both the Old and the New Worlds are smaller in the latter; that those peculiar to the New World are on a smaller scale; that those which have been domesticated in both have degenerated in America; and that, on the whole, America exhibits fewer species. In order to correct these impressions, Jefferson procured from America at his own expense and presented to the Comte de Buffon the bones and skin of a moose, the horns of another individual of the same species, and horns of the caribou, the elk, the deer, the spiked horned buck, and the roebuck of America. Buffon also maintained, much to the annoyance of Jefferson, that the American mastodon, or "mammoth," was the same as the elephant of Africa and Asia.

He does not seem to have had a very high regard for Buffon. In a letter to President Madison of William and Mary he wrote: "Speaking one day with M. de Buffon on the present ardor of chemical inquiry, he affected to consider chemistry but as cookery, and to place the toils of the laboratory on a footing with those of the kitchen. *I* think it, on the contrary, among the most useful of sciences and *big* with future discoveries for the utility and safety of the human race."

CONCLUSION

Dumas Malone writes that Jefferson became associated with an extraordinary number of important societies in various countries of Europe, as he had long been with the chief learned, and almost all the agricultural, societies of America. Much, but by no means all, of this recognition was due to his political prominence. On December 26, 1801, he was elected an "associé étranger" of the Institute of France; if this was by virtue of his position at all, it was because of his presidency of the American Philosophical Society. Mr. Malone says that this signal honor, which during his lifetime was shared by no other man of American birth and residence, may be attributed to his reputation in France as the most conspicuous American intellectual. He himself modestly interpreted it as "an evidence of the brotherly spirit of science, which unites into one family all its votaries of whatever grade, and however widely dispersed throughout the different quarters of the globe."

Modern scholars, according to Mr. Malone, have recognized Jefferson as an American pioneer in numerous branches of science, notably paleontology, ethnology, geography, and botany. Living long before the age of specialization, he was a careful investigator, no more credulous than his learned contemporaries, and notable among them for his effort in all fields to attain scientific exactitude.

But Jefferson saw all these branches of science not as independent units but as integral parts of an all-embracing whole that should be developed for the sake of the future happiness and prosperity of mankind, for the ultimate good of his fellow men was always in his thoughts. It was this scientific foresight that led him to advocate so vigorously the idea that science would be the cornerstone of our Republic. In 1789 he wrote to President Willard of Harvard: "What a field we have at our doors to signalize ourselves in. The botany of America is far from being exhausted, its mineralogy

is untouched, and its natural history or zoology totally mistaken and misrepresented . . . It is for such institutions as that over which you preside so worthily, Sir, to do justice to our country, its productions, and its genius. It is the work to which the young men you are forming should lay their hands. We have spent the prime of our lives in procuring them the precious blessings of liberty. Let them spend theirs in showing that it is the great parent of science and virtue, and that a nation will be great in both always as it is free."

Such was the opinion of Thomas Jefferson, the most versatile and the most influential of our American scientific men.

ETHNOLOGY.—*Pacific Coast Athapascan discovered to be Chilcotin.*[1] JOHN P. HARRINGTON,[2] Bureau of American Ethnology. (Communicated by WILLIAM N. FENTON.)

The purpose of this paper is to announce a discovery of great importance to ethnology made on my recent field trip to the Pacific Northwest. This consists of the disclosure that the so-called Pacific Coast Athapascan, about which much has been written in the past and which has been compared to Sarcee, Navajo, etc., is composed of a string of Chilcotin languages straggling down, and near, the west coast of the United States proper from what is now southern British Columbia to almost within sight of San Francisco, Calif.

The interior of Alaska and of most of northwesternmost Canada is occupied by a number of languages of the so-called Athapascan stock. In the forties of the past century Hale recognized Umpqua, of what is now Oregon, as belonging to this stock, and in the fifties Turner added the Apachean-Lipanan of the southern deserts and southwesternmost Great Plains of the United States to this stock. It became gradually clear through further study that the main body of the Athapascan stock is that of the far northwest of the North American Continent, and that from there two linguistic prongs have extended southward: (1) a Pacific Coast prong like the letter i (the dot would represent the Chilcotin), and (2) a more easterly prong accomplished via the "Great North Trail" along the eastern base of the Rockies south to where these mountains break down and thence west, or else via the intramontane region south, like the letter j (the dot would represent the Lipanan). In case of intramontane accomplishment, the j would have been executed hook first. The present study has succeeded in eliminating from the general Athapascan problem the Pacific Coast prong by discovering it to be a unit, having as its northern head part of the Fraser River drainage of British Columbia, Canada, and as its southern extent the zigzag watershed which bounds to the south Eel River's Southfork, in Mendocino County, Calif. The expression in the Chilcotin languages is just the opposite of this; in the manner of Chilcotin languages Indian talk, the peoples in their migrating layer on layer southward were working a language-substitution from the tail of the earth, which is located at what is now called Alaska and westernmost Canada, toward the earth's head, which is located in the far south. Genetic relationship of the Athapascan languages with the Tlingit (language of Sitka and Juneau, Alaska) and the Haida (language of the Queen Charlotte Islands) was shown by Sapir years ago. Work done by me a few years ago showed how close this relationship is, likeness extending to some 300 features.

Five detached bodies of Chilcotin languages were worked on:

(1) The most northerly of these was the Chilcotin proper, which takes its name from Chilco Lake, just east of the Cascade Range of mountains, in an easterly direction

[1] Received April 12, 1943.

[2] For important assistance in the consummation of this work, I wish to express my thanks to the following: The late Prof. Franz Boas, Prof. Melville Jacobs, Bess Langdon Jacobs, Mrs. James A. Teit, Prof. Edward Sapir, Prof. P. E. Goddard, Robert W. Young, Dr. Fang-Kuei Li, and the Missionaires Oblats de Marie Immaculée, as well as to various Indian informants who spoke the languages involved and remembered fragments of disused ones.

across the Strait of Georgia from the central part of Vancouver Island, and one of the sources of the Fraser River.

(2) The fragmentarily remembered language, closely resembling Chilcotin proper, of the Nicola and Similcameen Valleys, British Columbia, which had been sketchily made known by Dawson toward the close of the past century from information furnished to him by J. W. MacKay, formerly Indian agent of Indian Affairs Branch, Department of Mines and Resources, of the Canadian Government, stationed at Kamloops, British Columbia. A generation or two before this variety of Chilcotin would inevitably have become replaced by English, it became supplanted, in the latter half of the nineteenth century, by Indian languages of the Salishan stock. Working separately with eight different informants, I swept their memory clean of the former language and obtained a sizable and important list of vocables, the best results coming from the aged chief Ernest Billy and from his sister Matilda.

The information not only showed that the all-but-vanished language was Chilcotin, but details were volunteered that the speakers were called Stuwix-mux (Stuwix, Athapascan name of the Nicola Valley; Thompson -mux, person), that they made their last linguistic stand at what is now spoken of as the reserve at the southwest end of Nicola Lake, that the spring beside the Nicola Valley Brewery at the western end of the city of Merritt was magically created by them as a never-freezing drinking water supply and bathing place for the neighboring village of Teszulle, that these people used to steal children in order to augment their tribe, and that they formerly at times had clashes with the Thompson and other Salishan speaking bands that surrounded them. Best of all, came the information that the Chilcotin are called in the Thompson language Yuunxanii, a tribal name that has never been obtained or published on. This Chilcotin body was an enclave amid Salishan.

(3) The next Chilcotin language to the south was Kwalhioqua, occupying the Willapa River drainage and the adjacent drainage of the southern heads of the Chehalis River, in what is now southwestern Washington, centering about Pee-Ell Prairie (so called from the Indian pronunciation of Pierre, first name of a one-eyed Frenchman who used to farm the flat). This body was a second linguistic island, surrounded by alien Salishan and Chinookan.

(4) Another inland island of language consisted of the Tlatskanai (native pronunciation Łaats'qhanayu), who held, in upper, central, and lower divisions, the valley of the Claskanie River, a southern tributary of the Columbia, west of the present city of Portland, in what is now northwestern Oregon.

(5) The fifth and last Chilcotin division, as yet without a general name, was a great bloc of languages extending from Roseburg, Oreg., to Laytonville at the head of Eel Southfork, Calif., cut linguistically only by the Klamath River and unlike the divisions mentioned above in that it held many miles of coast, although the central part of its coastal holding, from Wilson Creek mouth, Del Norte County, California, to just north of False Cape, Humboldt County, Calif., was in Algonkin family linguistic ownership. This great southernmost Chilcotin group constituted seven languages: (1) Umpqua, or more precisely Upper Umpqua, who call themselves Tl'uutaneeyuu (prairie person); (2) Tututunne, from the head of the Coquille River to include the lower part of the Rogue River, Coquille and Shastacosta being perhaps the leading languages; (3) Galice, spoken on Galice and Applegate Creeks, southern tributaries of the Rogue River, remarkable for its appearance of ŋ, n, m as g, d, b, respectively; (4) Smith River, including Chetco; (5) Hupa, including Chilula and Whilcut; (6) Mattole, including Bear River; and (7) Wailaki, including Saya, Lassik, Sinkyone, and Kato. The farthest south extent of Chilcotin languages on the coast took in Usal Creek mouth. The Kato, at the head of Eel Southfork, abutting the Russian River watershed, were a little farther south than the Sinkyone co-speakers on the coast to their northwest, and again than the Wailaki co-speakers on Eel River proper to their northeast.

Even the Chilcotin is in many features

very Hupa-like, Kwalhioqua still more so, and in Umpqua to Kato one has practically straight Hupa grammar. For this southern division, therefore, perhaps a term Hupoid or Hupan would be practical.

According to meaningful consideration, the Chilcotin languages consist of the inherited morphom (meaningful form or element) and its inherited sequencing. The morphom may conveniently be considered as having two weights: (1) the theme (main or lexical meaningful form or element), to be written, with absence or presence of its crements, without spacing, and for indicating its crementless form always without hyphenization (the verb in these languages does not occur crementless); (2) the crement (subsidiary meaningful form or element), consisting of firmly attached affix or loosely attached clitic, to be written attached to its theme without spacing or hyphenization, but sometimes with hyphenization for perspicuity or weight indication. The theme minus or plus its crement or crements is termed the etymon (word or vocable), and it is the etymon that is dictionarized. The term base is a shortcut for standardized or extended theme.

There are in the Chilcotin languages four distinct, differently handled classes of etyma, or "parts of speech" to retain the terminology of the Greek grammarians. Retaining the Greek grammarian order of presentation, these are: noun, pronoun, verb, and particle. These four etymal classes reduce into two philosophical classes: noun, denoting entity, and verb, denoting action. The pronoun is a mere category carrier, appearing where the noun would be a more definite painter, or in addition to the noun. The verb is the equivalent of a pronoun-plus-verb-European-sentence. There are also copula and posture verbs and the like, which are to the verb as the pronoun is to the noun. They are handled as verbs, just as the pronoun is largely handled as a noun. The particle consists largely of adverbs of etymon rank of many formations, which definitize or add to the painting accomplished by the verb, and some of which, or their counterparts, can also be prefixed to the verb. These four etymal classes can be listed and characterized as follows:

(1) The noun is the label of entity. It admits of only certain adnominal prefixes and postfixes.

(2) The pronoun is handled mostly like the noun, but merely denotes unit of category, usually combinatory unit. The pronoun is cut into personic and demonstrative-numeroid divisions. Only the personic can be prefixed to noun and verb, one set of prefixes being used before the noun, and another, split into objective and subjective, before the verb, with the objective coming first if both are present. When prefixed to the noun, the personic becomes modificatory, as does the first member of a noun plus noun compound, and this modification has settled into possessive meaning. Numeroid pronouns suggest that numerals belong to the pronominal etymal class.

(3) The main part of the anatomy of any one of these languages is the verb, the base of which constitutes the last syllable, if there is no postfix syllable or syllables (compare the position of the verb at the end of the Latin sentence). Some of the verb bases assume as many as five phonetically different forms, but the principal ones for presenting slighter and fuller[3] form are the nonintegral and integral, which two forms of the verb base are the ones given in the present paper and in the order of nonintegral first and integral second. Some of the forms, both nonintegral and integral, of the verb base show a postfix or the remnant or reflex of one, as was detected by Goddard years ago. The nonintegral appears in the present indefinite and the imperative forms of Goddard and is the weaker or more reduced form of the verb base according to him, the imperfective of Li, in contradistinction to the integral, Goddard's past definite, Li's perfective, which is a stronger form. Some verb bases have according to closing consonant a slight and a full form, and this of nonintegral, or integral, or of both. Immediately before the verb base may come one or another, or in one instance even two together, of four classifiers (taking

[3] Or light and heavy, as Indo-Germanic ablaut forms are termed.

this terminology from Tlingit and other grammar), better called causo-agentive prefixes—four in number if we regard zero, or lack of classifier, as one of the four. The force of these prefixes is largely obscured in the Chilcotin languages. The most contractional part of the verb is the personic belt, consisting of personic objective prefix followed by personic subjective prefix with mode and aspect prefixes jammed in between these, a region of contractions comparable in complexity to the vowel contractions of the Greek verb. This order carries out the general word order of the languages of modificatory before main. Starting the verb, when occurrent, and preceding all pronominal prefixes, are the many adverbial prefixes of two positions, even including incorporated nouns used as adverbial modifiers.

(4) As the fourth and last etymal class, there can be lumped together adverbs, conjunctions, interjections, etc., all of etymal rank, under the blanket term anonynon, or particle. This class was Frachtenberg's catch-all, but the various groups of which it consists do have common characters.

Etymal classes 1, 2, and 4, in contrast to the verb, have comparatively few possible forms, and are therefore simple.

Some of the etymal forms have cremental counterings. Again, the postposition, which appears in these languages only as a category of postfixed transitive adnominal adverbs, may in other languages or writings have etymal, dictionary weight.

COMPARISON OF SOUNDS

The Chilcotin languages not only constitute a unit of linguistic development but also contain in Hupa, Mattole, and Wailaki, three of their members, preservation of sounds not even secondary to that of Tlingit and Haida in uniqueness for the reconstruction of the phonetic system of all Athapascan languages, including Tlingit and Haida. The Chilcotin languages, as well as Tlingit and Haida, evidence two back-of-the-tongue series.

The phonetic structure of the Chilcotin languages is, like that of language in general, an alternation of opener sounds called vowels, and closer sounds called consonants, comparable to slap-yelling—a procedure in syllables. Syllables are termed open or closed, open when having zero after the vowel of the syllable, closed when having a consonant after the vowel of the syllable, the consonant of course belonging to the same syllable. In actuality, most Chilcotin syllables are closed, either by a postvocalic consonant different from the one that starts the next syllable or by the doublish pronunciation of what would be otherwise a single intervocalic consonant whether within or between words. One can furthermore in all the Chilcotin languages divide the syllable closing consonants, into light and heavy closers, the light being on the whole slighter and including zero, and the heavy having fuller closing.

Language suffers changes and splittings. Changes, especially of sound, can be termed processes.

Reconstruction of a sound, morphological element, or word, won through comparison, of necessity synchronic in North America north of Mexico, is a device surely wrong in actuality, but nevertheless one that serves a temporary purpose. No amount of comparing of Romance forms would win back Latin with certainty even to the extent of a single word, though Italic dialects, Keltic, and Greek and careful procedure were to guide. The reconstruction of pre-Chilcotin is ephemeric but is comparable to a setting up of linguistic stocks in South America temporarily advantageous to the ethnologist.

The reconstruction of sounds is simpler than that of vocables in that vocables consist mostly of more than one sound. Taking a clue from the patent traveling backward of t to k in Lipanan (a group of Athapascan languages of the southwesternmost Great Plains), I spent considerable time in working out the assumption that Hupa k, x^w, etc., are frontals in antiquity that traveled toward the rear (like Swedish maskin, engine, becoming macin, and in dialect max^wina), but two indications made it plain that this assumption was wrong: (1) Related bunches of vocables in the lan-

guages themselves proved back-of-the-tongue origin; (2) the genetically related Tlingit and Haida proved back-of-the-tongue origin. It became apparent that the traveling of sounds has been in the same outward direction which in several centuries turned popular Latin ɬ into the s-sound of French.

Of course, all reconstruction takes us back only one jog, only to the extent of one chunk of time.

The assuming of a definite reconstruction form of any kind is by necessity more or less arbitrary. Even such a matter as to whether kh, x, or k is more ancient as a starter of the word for fire, must remain forever unsettled. It would not even be safe to guess that the more complex, which is kh in this instance, has been reduced.

Writing employs to a large extent different symbols for voiceless and for voiced consonants, and this tends to make the sounds in writing appear more different than they actually are in the mouth. For instance, English Siwash, and the French word sauvage, from which it comes, really have last sounds the same except for the matter of voicing, but the spelling makes these last sounds look very different.

Abbreviations of language names, such as Chil. for Chilcotin, used in presenting forms, do not require explanation. But Shastac. is used for distinguishing Shastacosta from Shasta.

VOWELS

As in Semitic, differences in vowels in the Chilcotin languages are not so important as differences in consonants.

A tendency is that a short vowel of an open syllable in the north appears largely as long in the south: Chil. si, I; Wai. cii. Chil. tθhe, stone; Wai. tshee.

There are several ablauts, or vowel mutations, notably that of o alternating with a, and that of e or i alternating with a.

Vowels occur short or long, as do consonants. Since the length of long consonants is conditioned by the simple rule that intervocalic consonants are long, all consonants are to be written short. But long vowels must rigidly be written long.

A nasalized vowel is, as in French, the result of an original syllable-closing -n, which nasalized more or less its preceding vowel, and was retained, changed to ŋ, or disappeared altogether, even the nasalization it produced disappearing in certain forms. Or a nasalized vowel is the result of a preceding nasal consonant.

a

Chil. -na, eye. The quality of a is more open than that of ɑ (a modification of i), with which it ablauts for instance in some verb bases.

o—u

o and u are variations of the same sound. There is a tendency to pronounce a glide ʷ between a dorsal consonant and this vowel (as for instance in Russian kʷómnata, room). It is a trait of several of the Northwest linguistic stocks and also of the Chilcotin languages that o labializes following dorsal consonant even through h preceding that consonant: Coq. c-xe', my foot; neenuh-xwe', our feet. In Tlingit, in some instances, even the a-sound labializes a following dorsal consonant.

In addition to inherited o—u, Chilcotin also shows ɑ transformed from o after a labialized dorsal: kwɑt, knee (for *kʷot); khwɑn, fire (for *khʷon).

e

Chil. tɑ-ne, person. e and i are kept distinct. Occasionally in a setting that would turn i to ɑ, I have heard e almost so turned, e.g., Navajo Tshé-khooh, Chaco, literally stone canyon, i.e., box-canyon, almost tsháhooh.

i

I have mentioned under o above one source of Chilcotin ɑ from ancient o. Another and still commoner source of ɑ is from i, conditioned to this extremely open form by contiguous consonant or consonants. Chil. łɑt, smoke.

VOWEL DIPHTHONGS

Vowel diphthongs are as in Tlingit and Haida of the class known as false, consisting of mere juxtaposition of two vowels of differing quality (Frachtenberg's au or aww, as in English hooey in rapid tempo, in con-

tradistinction to his aᵘ or aw). Any occurrent vowels of qualities different from each other may come together to make such a diphthong. Especially when one of the vowels is long, the false diphthong hovers on the border of being pronounced as two syllables. Nasalization of one vowel diphthong member is infectious to the other. Vowel triphthongs rarely occur.

SYLLABO-INITIAL CONSONANTS

Originating consonants travel different roads of development as to whether they start or close a syllable. It is therefore practical to prepare two lists of consonants, one of syllabo-initial consonants, the other of syllabofinal consonants, both drawing on the main or lexical elements of the languages. For restoring the originating consonants, Hupa, and to some extent Mattole and Wailaki, are important, since they postulate a palatalized or forward dorsal series reminding one of the separate forward series of Tlingit and Haida. For writing Tlingit and Haida, ʁ, χ, etc., are employed for the rearward series, k, x, etc., for the forward; however, mere k, x, etc., for the rearward-related and ķ, ɣ, etc., for the forward-related are used in writing Hupa.

LARYNGEALS

'-

In the Chilcotin languages nearly all vocables that would begin with a vowel have before this a momentary laying together of the moist glottal cords identical with the hamzated alif of Arabic and written by the apostrophe. Chil. 'a-thi, nonhuman trail. A few vocables begin directly with vowel, for instance, Chil. s-at, my wife.

h-

h- is rare, but occurs as the consonant of interjections, including the particle yes, and of song padders.

DORSALS

k-

Chil. -ket, -ket, to spear (fish).

k'-

Chil. k'a, arrow.

kh-

Kwal, khaxee, chief; Coq. xaxee.

When the original following vowel was e or i after a dorsal, the rearward of two back-of-the-tongue series is to be postulated, for all the languages retain kh- or the like. Chil. khe, foot; Hupa -khe'. Tlingit χ'ùs, foot, is a rear series cognate, but Tlingit khè, khèn, to track, also occurs.

x-

Though kh- largely appears as x- in the southern languages through declusivizing, when an originating x- is assumed there is no proof that x- was ever anything but a fricative.

Hupa is the only Chilcotin language, the only Athapascan language in fact, that still forms the word and prefix meaning I, my, on the back of the tongue, as Tlingit does, even Mattole and Wailaki presenting only forms leveled to c and the like. Hupa xʷe, I; xʷi-, my. Tlingit χà, I; 'aχ-, my. Chil. si, I; Wai. cii. It is only upon referring to other stocks that we find k-, etc., meaning I, my.

When the original following vowel was o, glide ʷ developed before it after a dorsal: Chil. su', all right; -zu, to be good; Hupa -xʷoŋ, to be good.

When the original following vowel was e or i after a dorsal, there is no way to tell whether the consonant belonged to a separate palatalized series, since the appearance in Hupa both of *x- and of *ɣ- is xʷ-. Chil. can, -yan, song; Hupa xʷiŋ.

r-

Chil. -ra, bodyhair. Tlingit χàw, bodyhair.

When the original following vowel was o, glide ʷ developed before it after a dorsal. Chil. -rʷu, tooth. Tlingit 'úx, tooth.

When the original following vowel was perhaps i, there is no way to tell whether the consonant belonged to a separate palatalized series. Chil. yāθ, snow; -ɣaθ, -ɣaθ to snow.

DORSALS LABIALIZED

rw-

Chil. -rwit, -rwat, to break intransitive-w is in these languages lowered from rw.

DORSALS PALATALIZED

ķ-

Chil. -ɣat, -ɣat, to fear; Hupa -ķit, -ķit.

Chil. -ɬ'uɬ, -ɬ'al, to tear transitive; Hupa -ɬ'iɬ, -ɬ'il.

kh-

When the original following vowel was o, no glide ʷ develops. Chil. -tcho, large, augmentative postfixed particle (but Chil. -tchoh, to become large, with retention of of original -x as -h); Hupa -ɬhoh.

When the original following vowel was e or i after a dorsal, the forward of two back-of-the-tongue series is to be postulated, because only Hupa, and to a partial extent its neighbors to the south, retain kh- or the like. Chil. -tche, tail; Hupa -ɬhe. Chil. tchan, stick; Hupa ɬhiŋ. (The word meaning stick is also used meaning tree in all these languages, with which agrees the use of English stick meaning both stick and tree in English local vernacular and in Chinook jargon.)

kx-

Some ancient affricative such as **kx-* may lie behind such appearance as in Chil. tshan, excrement; Shastac. sa', Hupa tchʷaŋ. Chil. -tsha, -tshe, to cry; Hupa -tchʷa, -tchʷe. Chil. tshaz, firewood; Hupa tchʷitc.

FRONTALS

t-

Chil. taδ, driftwood.

t'-

Chil. t'es, charcoal, to becharcoal; Coq. t'ec, black paint; to mark with black paint; Hupa t'exʷ, charcoal. to becharcoal.

th-

Chil. thuu, water; Ump. thuu.

FRONTAL LATERALS

ɬ

Chil. ɬi, dog; Kwal. ɬen; Hupa ɬiŋ; Tlingit khèɬ, dog.

l

Chil. -la, hand.

tl

Chil. tlat, rivergrass; Hupa lah, sea-lettuce (with tl- and l-).

tl'

Chil. tl'uɬ, string; Coq. ditto.

tlh-

Chil. tɬho, salve.

FRONTAL SIBILANTS

ts'

Chil. ts'ii, canoe; Kato ditto.

tz-

Chil. tzah, gum; -tzeh, -tze, to stick with gum; Hupa tjeh, gum. Chil. tzii, heart; Coq. se'; Wai. tjii. Chil. tzin, day; Wai. tjiŋ. Haida siŋ, day. For appearance in some of the languages as a complete s, compare e.g. Greek méssos, mésos, adj., middle, for *médhyos.

FRONTAL LISPINGS

Chil. -δe, mouth.

tθ'-

Chil. tθ'an, bone; Shastac. ditto.

tθh-

Chil. tθhe, stone; Shastac. θee; Hupa tshe. Tlingit thè, stone. Chil. -tθi, head; Kato si'. Tlingit cá, head.

n-

Chil. -nai, -nai', to drink; Hupa -naan, -naa'n.

LABIALS

p-

Chil. pan, roof; Coq. ma'n, house.

m-

The Chilcotins think of the Sekany tribe, which lives northeast of them, as substituting m- for p-, and do not know that their far southern linguistic cogeners do the same. The alternation p with m is widespread in American languages.

SYLLABOFINAL CONSONANTS

The Chilcotin languages have in general about a dozen consonants that can be syllabofinal. Only Hupa and Wailaki indulge in clicked affricatives of this position, e.g., Hupa and Wai. -t'ats', to cut, integral. Hupa also shows an affricative at the end of several forms where other languages would suggest a fricative, e.g. Hupa tchʷitc, firewood (the common dimunitive in Hupa is in -tc, compare man-tc, hut, literally houselet).

-'

Syllable-closing -' is in part original. It is sometimes the mark of the possessional form of the noun, of the perfective form of the verb base. It is also sometimes a reduction of older -k or -t; for instance, Navajo ka'nijii, white spruce, is for *kat-nijii.

-h

Syllable-closing -h is in part original. It is also largely a reduction of syllable-closing -x, as can be proved where it alternates with -r. Sometimes -h is entirely leveled out, as in Chil. -tcho, large. Sometimes -h stands for a former -k, -t, or the like.

-hθ

Not having listed the several syllable closures in -' plus a buccal consonant, -hθ should not be separately listed, but its appearance is curious. Chilcotin has merely yaθ, snow; xaθ, xaδ, to snow; yet Kwal. yahθ, snow, Coq. yahs, Kato yahs.

-k

Shastac. 'ak, cloud; Hupa 'ah, Wai. 'ah, show nicely -k having been preserved and having become -h.

-t

Chil. łat, smoke; Shastac. ditto; Mat. łih. Chil. -khoh, river; Kato khot, creek. The hardening of the preceding syllable results in a different history for this -t: Chil. -pat, belly; Hupa -mit', Mat. -pa'ł.

-s, -z

Chil. pas, bank; Coq. maθ. Chil. xaz, pus; Coq. xaθ. Chil. syllable-closing -s has in the languages down the coast very different appearances from Chil. syllabo-initial s-.

-n

In syllables originally closing with -n, four different grades of non-reduction and reduction can be easily distinguished in the languages: (1) complete -n; (2) appearance of -n as -ŋ; (3) appearance of -n as nasalizing of the vowel which formerly preceded it; (4) complete disappearance of nasalization. Sometimes two of these grades appear as distinguishing features in the forms of a verb base.

-m

-m appears as a syllable-closer in a few Chilcotin forms, but has gone over into the more limber -n and its developments in the other languages.

DISSYLLABIC ALTERNATION

A curious alternation between two-syllable and one-syllable forms, accomplished factually by thrusting -r- into the middle of the one-syllable form, appears in:

Shastac. θaraθ, black bear (compare perhaps with the last syllable Chil. caθ, grizzly); Chil. sas.

Chil. tł'aras, snake; Kwal. tł'as-khan'e, eel, literally river snake. Hupa łux^{w}, snake; łux^{w}-xan, eel, show Hupa ł- for tł'- (compare for instance Hupa l- for tl- in the Hupa word for sea-lettuce; pre-Hupa for snake should be *tł'ix^{w}).

Mat. k'arax, alder; Chil. k'as, Hupa k'ux^{w}.

DECLUSIVIZING, DEASPIRATING, DEALIFIZING, DEBUCCALIZING, ALIFIZING

Certain consonants in Athapascan languages, including Tlingit and Haida, have been encountered that just about run the gamut of homopositional type, and even that straddle articulational position, reminding one of Italian basso, low, Spanish bajo. The five processes mentioned as the caption of this section, all of them except the last mentioned accomplishing an easing, are encountered, and can be listed and exemplified here.

Perhaps the commonest of these processes is declusivizing, for instance, kh- in its emphatic or overaspirated form is kx- and is leveled solely to this appearance in some of the languages, just as Siouan kh- becomes solely kx- in Teton Sioux, and indeed in conformity for instance with the reduction of tθh- to θ-. I have even heard Navajo -ko, when, if, in standard tempo talk reduced to -xo. Chil. -khe, foot; Coq. xe'; Shas. xee.

Deaspirating is, in one way of looking at it, the opposite of the above process, whereby for instance an earlier kh- becomes k-. Mat. ke'-, foot, for pre-Mattole *khe'-.

Dealifizing is well examplified by Chil. -tluh, -tluk, to do by means of string; Chil. -tł'uh, -tł'u', to fasten with string.

Debuccalizing is again the opposite of the

just mentioned process. Chil. 'ɑ-, something or someone objective, verb prefix; Hupa k'i-.

An example of alifizing is shown between Chil. -k'aih, -k'an, to burn, and Chil. khwɑn, fire.

SPECIAL DEVELOPMENTS OF SOUND

There are many special or irregular developments of sound in the Chilcotin languages. Some of these changes are differentiations to avoid ambiguity. But throughout the languages one notices that special developments consist largely of easings of consonants in prefix syllables or in other much used forms. Thus Chil. ts'i-, someone, verb prefix (never a noun prefix), appears in Mattole as tji-, -'tji-, someone, verb prefix, someone's, noun prefix—with easing out of the clicking, just as a Zunyi schoolchild will say tz for ts'; Kwal. tantc'e, 4; Coq. tantc'i; Hupa tiŋk'; but Chil. taŋke. These changes are also suffered by bases and have been listed as the processes of declusivizing, etc., but prefixes and postfixes in the Chilcotin languages are especially prone to what may be termed special development. One can compare, for instance, the irregular verbs met with in many languages, special development of sound and form being caused by commonness of occurrence in various settings.

LACK OF TONAL ACCENT

Inherent tone of syllables is a morphologic and lexical as well as phonetic feature and is a characteristic of the northern, eastern, and southeastern Athapascan languages, but it does not occur, except as rare vestiges or as the cause of reflexes, in any of the Chilcotin languages. In coming from the inherent-tone Beaver, Chippewyan and Sarcee languages, which lie to the east of the Chilcotin languages, one is struck at once that the Chilcotin languages are not tonal, so much so that in these a noun may be distinguished from a phonetically equal verb form by signalizing the syllable or syllables of the noun by raising of tone. This lack of tonality is another common feature that makes for the unitizing of the Chilcotin languages.

In all the Chilcotin languages noun and verb form identical with noun can be distinguished by raising and loudening of voice for the nominally used form.

GRAMMATICAL AND VOCABULARIAL COMPARISON

The Chilcotin languages are characterized by large preservation of the possessive form of the noun; certain same nouns throughout the languages require someone's to be prefixed for not personally possessed form or when in certain meaning (Chil. -tche, tail; but tche, stream mouth); the same prioritive is common to a number of the languages; lack of addressative; the same postpositions with appositive personic plus postposition readier than noun plus postposition; the same personic plurals of the pronoun (we, ye); k'i- (and from this 'i-, 'ɑ-), someone or something objective, verb prefix (not *'ɑ-); the same demonstratives (Chil. -ti-, this; Chil. -yu-, that); verb base vriddhied by ablaut, orinasal umlaut, vowel lengthening, postfixation of syllable-closing consonants, as a maximum to five different forms and with k- to kw-, k'- to k'w- and kh- to khw- as a maximum of syllabo-initial consonant change; verb bases having the vowel consist of i prone to have one or few forms; nonintegral and integral action, nearer perfect and remoter perfect, immediative and future sometimes distinguishable by verb base change alone; certain verb prefixes and postfixes prescribe verb base forms; a separate class of verb postfixes outside of and after the verb base constantly and vitally in use even largely for tense distinguishment; verb base classification of entities such as earth, fire and water as well as according to shape or plurality; formation of passive from integral base; noun incorporation not confined to special forms but pretty largely practicable, in the adverbial belt; customary a secondary formation; nouns, pronouns, and particles, painters appositive to verb elements of vagueness; yi- (related to the remoter demonstrative) largely as adverb prop and as partial originator of the relatival; cardinal direction terms largely interlaced with stream and slope terms.

In addition to grammatical features *sui generis* these languages have the same pe-

culiar vocabulary, unitary inheritance of morphoms and etyma as well as their treatment; we point, for instance, to the numeral tąŋke, 4, which runs down the coast from British Columbia to Laytonville, to peculiar plant names, animal names, etc.

WIDER COMPARISON

A sensing of phonetics, morphology, and lexicality still wider than that gained from Athapascan, Tlingit, and Haida will be obtained by a comparison with genetically related stocks. A perspective even wider than this will be obtained by following out the suggestions given by the semantics of stocks whose genetic relation with Athapascan, Tlingit, and Haida can never perhaps be proved. For instance, the Algonkin stock, and again the Yuman stock, have bundles of vocables including the meanings to be white and to dawn. In Athapascan there occurs a verb to be white represented in very original form by Wai. -kai, to be white, and a verb to be daylight, to dawn, appearing for instance as Chil. khaih, khai, to be daylight, to dawn. Unconnectable, we say at present, yet surely connected.

INTERLINKING TRADITIONS

Hardest to get of all, and at the same time most satisfactory, were actually remembered traditions corroborating the linguistic evidence, which, although in part shading off into the mythical, are clearly indicative that there has been a southern spread of language-bearing ancestors, accomplished in war, opportunism, and peace, resulting in linguistic supplanting in large just-inland and coastal regions, and that the spread has been piecemeal, consisting of the throwing off of more southerly linguistic neighbors by more northerly adjacent ones. These tying traditions are 10 in number.

(1) Although in the Nicola Valley I obtained volunteered information that the Stuwix-mux language is Chilcotin, a more detailed account of this, presenting information transmitted to Dawson by MacKay, formerly Indian agent at Kamloops, British Columbia, is to be found in Dawson, "Notes on the Shuswap People of British Columbia" (Proc. and Trans. Roy. Soc. Canada 9 (sect. 2): 3–44. 1892). The first paragraph quoted presents information obtained by Dawson from MacKay, the second tells of Dawson's visit to an Indian in the Nicola Valley:

> A long time before the white man first came to the country, a company of warriors accompanied by their women from the neighborhood of the Chilcotin River made their appearance in the Bonaparte valley. . . . This happened during the salmon fishing season. . . . At that time it was customary for the Shuswaps who lived on the banks of the Thompson between Kamloops and the mouth of the Bonaparte valley to take their winter stock of salmon from the Fraser River at the western base of Pavilion Mountain. . . . The strangers from Chilcotin . . . continued their advance southward down the Bonaparte and Thompson valleys till they reached a position opposite the mouth of the Nicola River. At this place they were discovered by some scouts. . . . The intruders . . . took advantage of the night to cross the Thompson and proceeded to ascend the Nicola valley. . . . The strangers were driven into the Similkameen valley, where they took a firm stand. . . .
>
> An Indian named Joyaska, who lives in the Nicola valley, below the lake, and who is probably sixty years old, informed me [Dawson] . . . that he, with seven other men and some women and children belonging to them, were now the only remaining true natives of the Nicola region. . . . I asked him if the old language was like that of the Tsilkotin . . . to the north, and he said it was the same.

One may discredit this story, which is given even in more detail that I have quoted above, but I got enough information in the field to convince me that it has some basis of fact in the remote past.

(2) The Kwalhioqua tradition that they spoke the language of the land-otter and migrated far from the east, apparently contains dim handed-down memory blended with a standardized linguistic metaphor. I have recorded elsewhere Indian language metaphors that a foreign people talks the language of ducks, or again of blackbirds.

(3) The Kwalhioquas also have a tradition concerning the Tlatskanai. They tell that the Tlatskanai are an offshoot of their own people. Some Kwalhioqua youths, borrowing and misuing a firedrill, started a great forest fire and, when this subsided, followed the tracks of an elk easily discernible in the ashes south through alien terri-

tory to the nearby Columbia River. On crossing this river they found good elk hunting in the region of the Claskanie River on the south side and sent a messenger back with a lot of dried elk meat. The messenger succeeded in persuading many of the Kwalhioqua to migrate to the Claskanie Valley, which they did, thus initiating the Tlatskanai tribe.

(4) A third Kwalhioqua tradition is that the Umpquas are, like the Tlatskanais, a body of Kwalhioqua who migrated south. This tradition is of the utmost importance since the Umpquas belong to the southernmost group of Chilcotins.

(5) The Tututunne, whose great village was on the north bank of lowest Rogue River at what was later called Bagnell's Ferry, have a tradition that they migrated to that site.

(6) The Mikonotunne, whose village was on the north bank of Rogue River about seven miles above that of the Tututunne, have a tradition that they migrated upriver.

(7) There was a place somewhere up the Rogue River above Shastacosta village called Maanesta. At Shastacosta village two chiefs quarreled. One of these chiefs wandered upriver and established Maanesta in a narrow place of the river full of hazelbrush. People climbing the mountain sides at Maanesta would see the smoke of Shastacosta village far downriver toward the coast and would say to their accompanying youngsters, "Those are our people, we came from there."

(8) There is a tradition among the Smith River Indians telling that the Hupas are Smith Rivers in origin, though the Hupas are now separated from the latter by the alien-speaking tribe of the lower Klamath River, and the differences between Smith River and Hupa must have required long separation to attain. It is said that ten boys and ten girls left Burnt Ranch village on Smith River, that the trail magically opened up before them so that they walked without crossing water to Hoopa Valley and became the Hupa Indians. The Hupa Indians in their language today sometimes refer to the Smith River Indians as little Hupas, which implies recognition of relationship.

(9) A somewhat similar Smith River Indian tradition states that the Whilkuts of Blue Lake, speaking a language closely related to Hupa, originally lived at South Bend on the Smith River, and that ages ago they migrated south, fighting off enemies as they went, until they finally reached Blue Lake.

(10) The Hupas have the tradition that the Saya, also called Nongatl (saya in the Chinook jargon means far off), who used to adjoin the Whilkut in the hills east of Humboldt Bay, are Hupas who moved south long ago. As proof of this, the information was volunteered that a Hupa can understant the Saya language after hearing it for a while.

CONVERSION OF LINGUISTIC CHANGE INTO CHRONOLOGY

One may ask, after all the above, the practical question: How long have the Chilcotin languages been developing asunder? To this question no answer can probably ever be given. Linguistic change has had for various features various and varying rates, and no amount of study will convert as a whole the duration of the linguistic change sundering these languages to time reckoning, even to the extent of a good guess.

ENTOMOLOGY.—*New species of flies of the genera* Baccha *and* Rhinoprosopa (Syrphidae).[1]

F. M. HULL, University of Mississippi. (Communicated by ALAN STONE.)

In recent studies of syrphid flies, some new species of *Baccha* and *Rhinoprosopa* from the neotropical regions were discovered and are described in this paper. The types, except where designated, are in the collection of Dr. C. L. Fluke, of the University of Wisconsin, whom I wish to thank for the loan of this material. Paratypes, where available, are in the author's collection.

Baccha minima, n. sp.

Abdomen with a pair of widely separated yellow rectangles in the basal corners of the fourth segment. Third segment with a pair of basal vittae on each side. Related to *sativa* Curran.

Male.—Length 8 mm. Head: face and front yellow, the latter with a black dot on lunula. Pile sparse, black. Antennae orange, third joint missing. Thorax: mesonotum brassy black with a pair of wide, yellowish-gray vittae running nearly to the scutellum. Humeri and lateral margins widely yellow; a medial spot adjacent to the humeri, yellow. Pleura yellow, brownish on the metapleura and hypopleura. Scutellum yellow with a few black hairs and one or two black fringe hairs. Abdomen: slender, shining black; the sides of first segment are yellow, the remainder brown. Third segment with a pair of narrowly separated yellow vittae in the middle of each side. Fourth segment with a large, rectangular yellow spot on the lateral margins and base of the segment, the two spots not widely separated. Fifth segment shining black. Legs: yellow, the hind femora with a brown subapical annulus, their tibiae with the middle yellow and proximal to it a dark brown annulus and the distal third brown. Hind basitarsi yellowish brown, the apical joints dark brown. Wings: pale brown, the stigmal cell quite dark; costal cell clear; alulae absent.

Holotype, male, Nova Teutonia, Brazil, Fritz Plaumann. (Fluke collection.)

Baccha delicatissima, n. sp.

Characterized by the dark aeneous-brown mesonotum and scutellum. Hind femora and tibiae brown, yellow centrally.. Related to *macer* Curran.

Male.—Length 7.5 mm. Head: face and front yellow, the former with a black spot on lunula and black pile, facial pile yellow. Antennae orange, blackish above. Thorax: mesonotum brassy brown, the margins obscurely yellow without apparent vittae. Scutellum concolorous with four or five long black hairs, no fringe or collar. Halteres black, squamae pale. Pleura wholly yellowish. Abdomen slender, brownish black; second segment light brown on the basal corners, with small, oblique, widely separated, light-brown spots just past the middle. Third segment with a similar oblique middle spot on each side. Fourth segment with a wide, separated vittate spot beginning some distance from base and near the middle of the segment proceeding diagonally to the margin. Fifth segment with a pair of oval vittate spots. Legs: yellowish, the middle femora except at base, all of hind femora and tibiae pale brown. Femora with subapical bands and tibiae dark brown basally and apically. Wings: pale brown; stigmal cell dark, costa lighter; alulae absent.

Female.—Similar to the male, front with a slender brown stripe; spots of fourth segment form well-marked, short, inverted V's.

Holotype male and *allotype* female, Nova Teutonia, Brazil, Fritz Plaumann. (Fluke collection.)

Baccha zilla, n. sp.

Related to *virgilio* Hull. The front is wholly pale, the third and fourth segments of the abdomen with two vittae on each side, each pair basally confluent. Scutellum and pleura, except the metapleura, pale yellow.

Female.—Length 8 mm. Head: face and front pale yellow, the latter with sparse black hairs, the vertex as far as the first ocellus blackish; lunula with a black dot, antennae orange, the third joint missing. Thorax: greenish shining black, with a pair of pale gray-brown, anteriorly wide vittae reaching over the anterior half. Pleura except the metapleura, the humeri, the wide lateral margins and scutellum, all pale yellow. The scutellum has five or six pale hairs

[1] Received March 13, 1943.

on the ventral fringe and a very few hairs on disc. Abdomen: elongate; slender; about the same length as wings; the first segment is yellow on the sides, with yellow pile; second segment with a long, narrow, medial black vitta, the apical fifth black, the sides yellowish; third segment with a long, slender pair of yellow vittae reaching to the base and basally fused on each side of the segment. They cover nearly three-fourths the length of the segment. Fourth segment similar, the vittate spots shorter. Fifth segment with a pair of short, reddish vittae. Legs: yellow, the hind femora brownish subapically, their tibiae pale brown, yellow in the middle, their tarsi dark brown. Wings: pale brown; stigma dark; alulae absent.

Holotype.—Female, Nova Teutonia, Brazil, Fritz Plaumann, and a *paratype* from Nova Teutonia and one also Puyo, Ecuador, December 1938, F. M. and H. H. Brown. (Fluke collection.)

Baccha nerissa, n. sp.

Related to *columbiana* Curran. The pleura are steel-blue. Hind femora and tibiae black. Third to fifth abdominal segments trivittate.

Female.—Length 11 mm. Head: face yellow laterally, its middle and the cheeks blue-black and white-pollinose; the front is black, black-pilose, narrowly yellow on the sides and linearly white-pubescent. Antennae dark brown, the third joint orange below, blackish brown above, and rather elongate. Thorax: mesonotum dull black, with a faint bronze cast and a pair of wide, narrow, gray vittae reaching almost to scutellum. Pleura steel-blackish; scutellum dark brown, with sparse black pile and long, mixed, ventral fringe. Abdomen: petiolate, the first segment metallic black and extending onto base of second. Second segment orange laterally and brown apically with opaque central triangles; third and fourth segments reddish brown, with a medial black vittae and a lateral black triangle, all apically confluent, the post-margins brown. Fifth segment trivittate; sixth trapezoidal, basally flattened and black, laterally compressed apically. Legs: first four brown, dark at base of femora, pale yellow at base of tibiae; hind femora and tibiae black, tibial base narrowly yellow. Hind basi tarsi basally black; remainder of tarsi pale. Wings: pale brown, dark brown on anterior border, almost as far as end of stigmal cell. Alulae wide.

Holotype female, Pinas, Ecuador, 1,200 meters, July 21, 1941, D. B. Laddey. (Fluke collection.)

Baccha nigrocilia, n. sp.

All the legs jet black, with similar pile, longer on the hind pair, the hind tarsi in part yellow. Wings brown on basal half, anterior tarsi dilated. Related to *hirta* Shannon.

Female.—Length 9 mm. Head: face and front steel-blue, the former narrow yellow on the sides, the latter protuberant anteriorly, widely shining black in the middle, with black pile; lunula and antennae black. Thorax: mesonotum and scutellum shining black, with black pile and ventral fringe, the notapleura bluish, the humeri sepia, the pleura steel-blue with vertical silver pubescence and silver pile and black-pilose on posterior half. Squamae and fringe black. Abdomen: strongly petiolate; first segment shining black and steel-blue posteriorly; second segment steel-blue on the basal third and side margins, with in the middle a pair of oblique black spots meeting above. Third segment reddish in the anterior corners, with large, central, opaque black triangle, which is postmedially indented; the posterior and anterior margins are shining. Fourth segment steel-blue, with, on each side, a large, opaque triangle posteromedially connected to a median black vittae that does not reach the base. Fifth segment with three black vittae on steel-blue ground. Sixth segment flattened, trapezoidal. Legs: jet black and pilose, the pile quite long on the hind pair; apex of hind basi tarsi and next two segments whitish. Anterior tarsi dilated, wings brown on basal half. Alulae very large, stigmal cell pale.

Holotype female, São Paulo, Brazil, February 18–26, 1940, Ilha Seca; one *paratype* female. (Fluke collection.)

Baccha nigrocilia inclusa, n. var.

In this variety, from Colombia, the vittae are slender and isolated and contained within the triangles of opaque black upon the abdominal segments.

Baccha nigrocilia hirtipes, n. var.

In this variety, from Colombia, there are large yellow-brown triangles in the lateral corners of the second to fifth segments; the vittate spots are also yellow.

Rhinoprosopa lucifer, n. sp.

Related to *aenea* Hull but the pleura are chiefly black, the facial stripe is wider. Hind tibiae black.

Male.—Length 11 mm. Head: the cheeks and sides of face are widely pale yellow; middle of face widely jet black. The sides of the front are orange, broadly opaque black down the middle, expanding to reach the sides of the shining black lunula. Face produced considerably beyond the antennal apex, with a low tubercle below the antennae. Antennae reddish brown, the third joint blackish except at the ventral base; arista black. Pile of front black and long and confined to the top and sides. Vertex black with black pile. Thorax: mesonotum brassy brownish or black, the anterior half brownish-gray pollinose, without definite vittae and with long yellow pile. Humeri, the whole of notapleura, postcalli, and a sharp wide basal margin on the scutellum yellow. Remainder of scutellum dark brown, lighter on the margin, its pile long, sparse, and black, with longer marginal bristles and no fringe. Only the posterior half of the mesopleura is yellow. Abdomen rather slender, especially at the end of second segment, black with yellow markings as follows: all but the posterior margin of the second segment in the middle yellow. Second segment with a pair of long, oblique, anteriorly approximated, bright, central, yellow stripes upon the sides of the segment, each stripe margined anteriorly with opaque black and posteriorly with an opaque triangle. Third segment with similar pattern, the stripes almost confluent anteriorly. Fourth segment with larger, similar stripes which are fused throughout most of their length in the middle. Fifth segment with oblique, transverse, short fascia fused medially. Legs: yellow, the hind femora dark brown on more than the apical half, their tibiae and tarsi very dark brown. Wings: wholly deep brown with slender alulae, equally developed throughout.

Holotype male, Pinas Ecuador, 1,600 meters, July 25, 1941, D. B. Laddey. Two *paratype* males, same data. (Fluke collection.)

ZOOLOGY.—*A folliculinid associated with a hermit crab.*[1]

E. A. ANDREWS, Johns Hopkins University, and E. G. REINHARD, Catholic University of America.

The folliculinids are a small group of ciliated Protozoa living in colored, chitinoid tests, scarcely visible to the naked eye and firmly attached to various objects in all the oceans of the world. When the animals leave these tests to make others, the old ones persist and are recognizable as representing species and genera.

Hermit crabs drag about deserted snail shells, within which their soft spirally grown hind bodies are protected. That certain folliculinids live attached to the soft bodies of hermit crabs, within the shells of snails, was observed in 1888 by Giard, in France. He saw them as little black spots on the hind body, near the limbs or near the end of the hermit crab *Pagurus bernhardus*, then called *Eupagurus bernhardus*. These specks proved to be groups of folliculinids, which he thought to be well placed to receive currents of water along the hind body. The shape of each test was so peculiar, being pinched in with an upper and lower part, something like a double gourd or gourd-shaped piece of pottery, that he made them representatives of a new genus, *Pebrilla*.

No other mention of this association was made for nearly 50 years, and then, in 1936, Fauré-Fremiet on the coast of France found these same folliculinids associated with the same hermit crab, but also with another, *Clibanarius misanthropus*. He found them standing solitary or in groups of four to seven on the hind body of the crab only, and never upon the inside surface of the snail shell.

Though the pinched-in shape of Pebrilla suggests some outside force, Fremiet observed the animal secreting its test in two efforts, first the posterior part and then, with change of shape and of secretion zone, the anterior part, entirely from within and with no external compulsion. This folliculinid, *Pebrilla paguri* Giard, is known only as

[1] Received March 26, 1943.

occurring upon the above two sorts of hermit crabs and as observed by the above two naturalists.

In studying the hermit crab *Pagurus pubescens* Kröyer, living in the shells of the snails *Littorina litorea*, *Thais lapillus*, *Buccinum undatum*, and some others and collected from shallow water in Frenchman's Bay, coast of Maine, between Mount Desert Island and the mainland, one of the authors in 1939, 1940, and 1941 observed blackish spots, which proved to be tests of some folliculinid, scattered over the hind bodies of these crabs. After preliminary study of these objects, involving the preparation of whole mounts and some serial sections of crab abdomens, he turned over this material together with preserved crabs fixed in Gilson's fluid to the senior author for detailed investigation.

This association of folliculinid and hermit crab proves not to be the same as observed in France. The folliculinid is a different species and genus, and the hermit is also a different species from either of those mentioned in France. There are no records of folliculinids on other sorts of hermit crabs, but on one out of a dozen specimens of *Pagurus longicarpus* from Woods Hole, Mass., three or four tests of a folliculinid were found near together on the right side of the antepenultimate segment. These seemed to be *Lagotia viridis*, which is one of several folliculinids that occur in that region. It is common on algae and hydroids, and the few found on the hermit crab may have been stray experimenters.

Examination of a dozen *Pagurus pollicaris*, also from Woods Hole, failed to reveal any folliculinids, and *P. acadianus* from Maine seems likewise free of these Protozoa. However, on five out of six *Pagurus hemphilli* received for examination from the U. S. National Museum and dredged in Cuylers Harbor, San Miguel Island, Calif., in July 1939, there were folliculinids much resembling those on *Pagurus pubescens* from Maine, both in general appearance and in distribution on the abdomen, but they prove to be *Lagotia simplex* Dons as understood by Fauré-Fremiet in 1936. It is not every specimen of *Pagurus pubescens* from Maine that bears folliculinids. Fifty-five adult females, not hosts of *Peltogaster*, showed folliculinids on 39 and none on the rest. Some of the latter were no doubt recently molted crabs and accordingly could not be expected to have attached commensals. The little tests (Fig. 1) stand fixed only to the dorsum and the sides of the hind body and are strikingly more numerous toward the posterior end.

Thus, dividing the abdomen into swollen anterior segments and the terminal part (the latter consisting of the last segment with uropods and telson), we found that in the above 39 there were 89 folliculinids on the swollen region and 237 on the terminal region.

This crowding toward the hind end, which lies far within the spiral of the snail shell, is just the reverse of the distribution of the little bivalves, juvenile *Mytilus edulis*, that were found abundantly attached by byssus threads to the rough anterior free parts of the crab, but very seldom on the hind body.

Why the folliculinids find the terminal region of the crab's body more suitable for attachment than any other arouses speculation. The answer, we believe, may be found in the fact that the apices of the shells inhabited by hermit crabs are generally choked with organic refuse, including fecal material, which must be a rich culture medium for various microorganisms. Since this is pocketed in a relatively stagnant environment, the folliculinids on the terminal portion of the crab's abdomen seem particularly well located to have an abundance of food always at hand.

These folliculinid tests are scattered here and there, often as solitary and quite often as grouped individuals (Fig. 1). The groups are made up of 2, 3, and up to 17 individuals (Fig. 2) and suggest that the swimmers that settle and build have some methods of reaction to one another and are to some extent social. Like many species of folliculinids, these may group themselves in depressed areas of the surface, and often we find them in aggregates along the grooves bounding the last segment, where the largest groups were seen (Fig. 2). Here the swimmers must have settled about the same

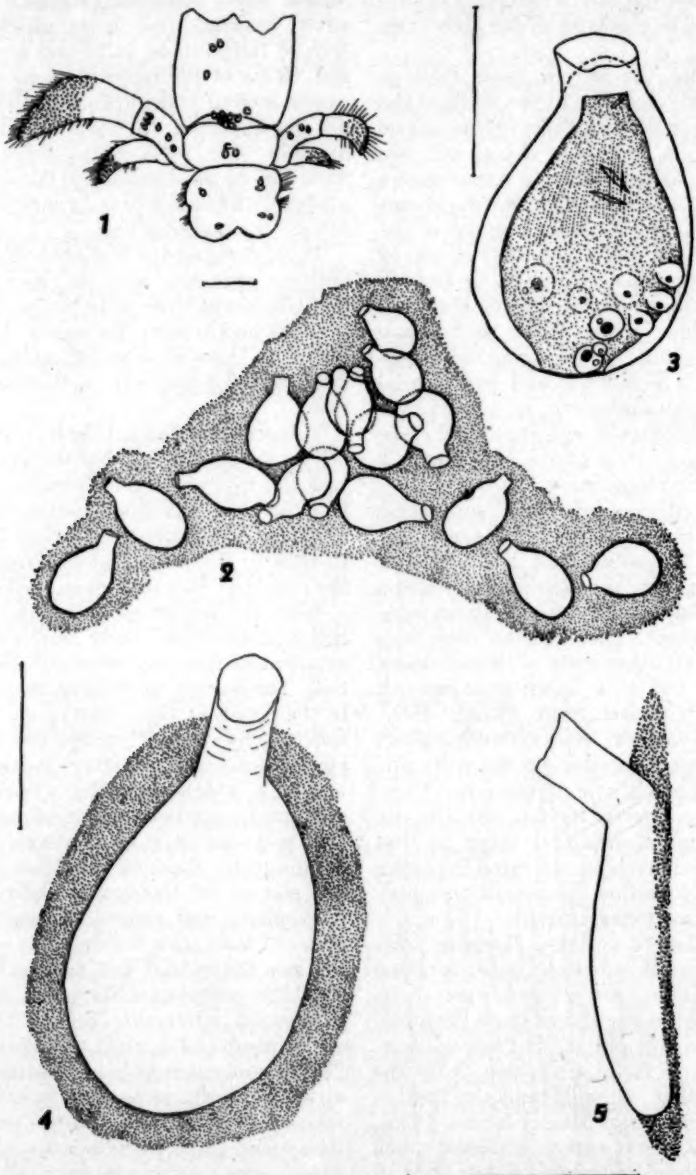

Fig. 1.—Dorsal view of end of abdomen of *Pagurus pubescens* showing distribution of about 30 folliculinid tests. Fig. 2.—Largest group of 17 folliculinids extending in groove outlining telson, all tests connected by basal colletoderm, some built on top of others with outlines distorted from crowding. Fig. 3.—Folliculinid with nine *Pottsia infusorium* parasites projecting from rear portion, and few diatoms in front part. Fig. 4.—Top view of folliculinid test surrounded with halo of cement. Fig. 5.—Profile view of same specimen as Fig. 4.

Each side line represents 100μ except in Fig. 1, where it represents 1 mm.

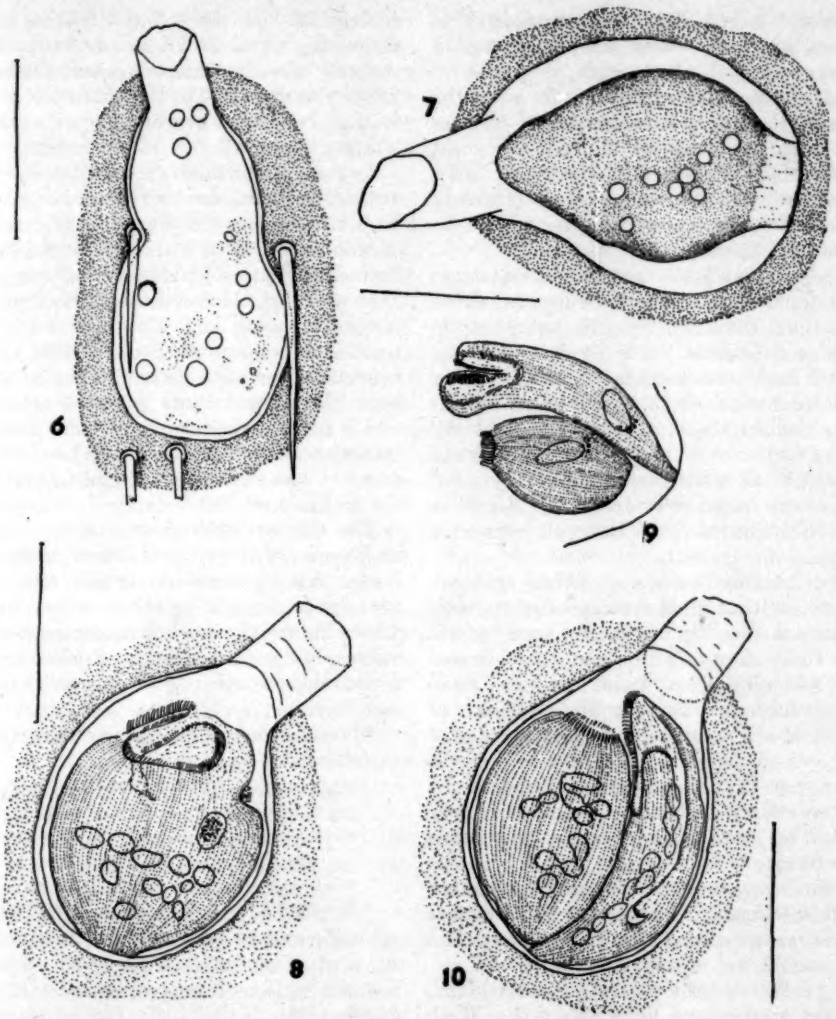

Fig. 6.—Dorsal view of folliculinid test distorted by pressure against setae of surface of last pleopod of *Pagurus pubescens*. Contents of test reduced to scattered nuclei, chiefly. Outline suggests that of *Lagotia*. Fig. 7.—Partly preserved folliculinid with wide base of attachment to test. The wide stalk abnormally cleared of granules except at the attaching surface. Eight nuclei in view. Fig. 8.—Ventral view of folliculinid fixed in Gilson's liquid, showing unequal peristomial lobes, pharynx, and part of gullet; with 11 unequal nuclear lobes and large fecal vacuole approaching small remnant already discharged. Fig. 9.—Two folliculinids fixed in Gilson's liquid in partly destroyed test, each with one macronucleus and several micronuclei. They are the separated anterior and posterior halves of one that divided crosswise; the one on the right retains its contact with the test and is developing unequal lobes; the one on the left was the anterior half and is free from the test; its terminal membranella crown is that of a free-swimmer, but there is a small protoplasmic protrusion near it. Fig. 10.—Ventral view of folliculinid test containing two results of recent fission; the anterior part to the left has terminal crown of a swimmer and 10-lobed nucleus; the posterior part, to the right, retains basal attachment, has a 9-lobed nucleus and two unequal peristomial lobes, with the nascent pharynx still at the posterior third of the body.

Each side line represents 100μ. All figures (1–10) are of *Platyfolliculina paguri*, n. sp.

time and crowded as close as possible to others, and some even settled on top of those already in place. Such overlying individuals show irregular outlines, since the sides of their tests were hampered by contact with the necks of the tests they sat upon. It will be noted that the colony has a dense center where they parked so closely as to leave no vacant spaces, just as is the habit of *Metafolliculina andrewsi*.

These tests show no common orientation; even in closely crowded groups the members that stand side by side have axes in various directions. Each test is a very flat simple flask with short neck, and it is surrounded by a halo of cement that fastens it to the surface of the crab (Figs. 4, 5). When two or more settle near together the cement of all binds them together by a flat membrane called colletoderm by Wright in 1859. Peeling this from the crab removes a group as one mass.

It is notable that many of these tests are empty, so that good specimens of the animal are not readily found. One group of ten had eight empty. To be sure, it is known that folliculinids may swim away and leave empty tests, but here we find evidences of death of the animal, such as remnants of protoplasm with groups of nuclei (Fig. 6). That some of the many empty tests may be the results of attacks by parasites is suggested by facts to be presented later on in this paper.

Proceeding now to a detailed description of these folliculinids associated with *Pagurus pubescens*, we consider first the test and then the animal, not observed in life.

By reflected light the tests are soot-black, but by transmitted light pale green. Each is a flat, wide sac with insignificant neck that lacks a special collar at its mouth. The floor of the sac is quite flat and the roof but slightly arched. The sac adheres by a thin layer of cement under its floor and extending 20–50μ as a halo around the floor of the sac. The underlying cement may rise up posteriorly to the top of the sac roof. The short simple neck has a thin wall, while the sac seems to have a thick wall, but this is the optical effect of the curvature of the sides, which in a horizontal distance of 5–6μ descend 25–30μ, the top and bottom views suggesting outer and inner boundaries of the wall. That is, where the greatest diameter of the sac is 125μ the diameter of the floor is 115μ—the overhanging sides simulating a thick wall.

As the sac is so flat, top and bottom views are readily seen but profiles scarcely ever. In bottom views the sharp line of junction of side and floor is striking. Actual longitudinal sections of the test give the appearance of a test tube with blunt bottom and upturned mouth end. The material of the test looks homogeneous except that in the cement and sometimes in the walls of the neck there are minute particles, some of which are the original subpellicular granules (protrichocysts of Klein) discharged and more or less swollen and fused to make all the test and cement.

The flimsy necks show various lengths and angles of rise from the floor of the sac, but as side views are rarely seen the measurements of neck length are not exact. Views down the neck sometimes suggest valves, but none was demonstrated. Rarely is the thin mouth edge thickened slightly as a 5μ rim.

The range in size in 25 measured tests is as follows:

Total length	188–238μ
Sac length	138–188
Neck length	35–75
Sac width	90–150
Neck width	38–60
Mouth width	30–63

As estimated by focusing, the depth of the sac is often but 25μ and rarely 50μ, while in paraffin sections it was measured as 25, 28, 35, and 38μ.

The tests are not so strictly symmetrical as in many other folliculinids, and there are some monstrosities. One had a neck from a sac of 125μ length extended to a total length of 113μ. This resulted from the fact that its first portion of 50μ length was followed by a secondary extension of 63μ off at a large angle.

Straight extensions of necks are common in some folliculinids. The sides of the sac are not infrequently indented, and usually this has arisen from resistance of setae on the

shell of the hermit crab, or from necks of other tests, as in Fig. 2. When, as in Fig. 6, the swimmer settled between setae too near together its test was distorted on opposite sides so as to somewhat suggest the pinched-in form of *Pebrilla paguri* found on hermit crabs in France.

Knowledge of the animal within the test is hampered by effects of parasitism and methods of fixation of the crabs. Though one remnant had a length of 250μ, most were strongly contracted down into the sac with the peristomial lobes but poorly preserved. The left lobe was considerably bulkier than the right. What was seen of the pharynx was not deep and possessed few spirals.

Nuclei appear clear in dead remnants and as dark-stained spherules after borax-carmine or haematoxylin. Generally 9, but up to 13 in number, are present. Rarely seen connected, they are of unequal mass, 5–15μ in diameter. Each nuclear lobe is closely surrounded by a layer of granules. Accompanying these macronuclei were sometimes darkly staining unequal spherules about 1–2μ in diameter and deemed to be micronuclei. Longitudinal pigment bands were counted as 30–35 in dorsal view. Food vacuoles were seen and some diatoms within the protoplasm, anteriorly; also fecal vacuoles. What is of import is that where the animal had not been separated from the sac it was attached posteriorly by a broad base, 25–45μ wide (Fig. 7).

Seeking a name for this folliculinid associating with *Pagurus pubescens*, we find that its multiple nucleus places it in the Eufolliculininae where its wide flat sac, short neck, and broad base of attachment of the animal bring it near to what Hadzi, in 1938, called *Platyfolliculina sahrhageana*. Hadzi found in the Adriatic two undescribed forms in the subfamily Semifolliculininae with broad bases of attachment; thinking this important he worked over the illustrations given in 1917 by Sahrhage when describing division in what he thought *Folliculina ampulla* (a name applied to many different species). Hadzi concluded that Sahrhage's illustrations should be taken as representative of a new genus, *Platyfolliculina*, to be called *P. sahrhageana*. He estimates the dimensions to be:

Total length of test	137–237μ
Breadth of sac	91–109
Breadth of neck	34–50
Width of mouth about	43

The extended animal was 243–250 by about 30 but when retracted 85–132 by 59–33μ. The macronuclei were generally six in number and up to 17μ in diameter; and the micronuclei up to five in number.

Sahrhage's species came from algae and piles in Kiel Harbor, but ours on *Pagurus pubescens* has much resemblance to it. Moreover, in one of these crabs fixed in Gilson's liquid, two tests were found containing stages soon after division, as described by Sahrhage.

In the first (Fig. 9) two animals occur side by side, each with one macro- and several micronuclei. This is evidently a stage immediately after the moniliform nucleus condensed into a rod that divided into anterior and posterior halves, as the protoplasm pinched in ventrally to separate an anterior from a posterior half. Of these the posterior stands attached, while the anterior has slipped down along the side of the posterior half and stands beside it and free.

In the later stage (Fig. 10) the macronuclei have increased to the normal number while the original anterior half still remains alongside the posterior half preparatory to swimming free; the posterior half, on the right of the illustration, is perfecting its unequal membranella-bearing lobes, though as yet the opening of the infundibulum is far back in the posterior third of the animal and will need to be brought forward to function. In general, as here, the ontogeny of any folliculinid starts as a rodlike form, *I*, then this splits deep to form almost a *V*, and later elongates the stalk to fashion a *Y*-form the arms of which are of different lengths in different species and in different phases.

Provisionally, we assign this folliculinid on *Pagurus pubescens* to the genus *Platyfolliculina*, but as the nuclei are more numerous, the necks longer, and the sacs wider than in *P. sahrhageana* it seems to belong

to a new species here named **Platyfolliculina paguri.**

These platyfolliculinids associated with *Pagurus pubescens* live well protected in the restricted, dark spaces of the snail shell, yet as they multiply there it is evident that adequate food is present for them and for other ciliates also residing there, such as the large branched colonies of vorticellids and upstanding tube dwellers seen in 7μ sections as 45μ long *Cothurnia.*

When the animals are present in their tests they frequently bear at the posterior part (Fig. 3) several spheroidal protrusions, 4–30μ in diameter, each with a large nucleus 4–10μ wide and often also with a smaller embryo cavity 2–5μ wide, external to the nucleus.

That these projecting cells are actually parasites fastened to the folliculinid is certain when they are compared with the results of Chatton and Lwoff, who in 1927 described a new and remarkable suctorian that lives as parasite upon two species of folliculinids and two species of vorticellids. When mature these parasites project just as in the folliculinids we find upon *Pagurus pubescens.*

These authors, in 1924, found that *Folliculina ampulla* was badly infested with these parasites in the aquaria at Monaco, while the rare *F. elegans* had none. Also *Folliculina ampulla* brought from Samoa and from Woods Hole, Mass., by F. A. Potts, lecturer at Cambridge, showed these parasites. These suctoria, named *Pottsia infusorium*, are peculiar in the group of acinetans in that the embryo released from the cavity of the adult in which it was formed by budding has three bands of locomotor cilia as well as terminal sucking tubes by which it anchors itself to the body of the folliculinid and grows to maximum size by drawing out liquid from the host. As many as 22 were seen on one folliculinid, and these authors think that greater numbers kill the host folliculinid, after which they gradually perish within the host's test. This may account for the many emptied tests seen on *Pagurus pubescens.*

Finding *Pottsia infusorium* as parasite on these folliculinid associates of the hermit, *Pagurus pubescens*, thus adds Maine to their previously recorded geographical distribution, Samoa, Monaco, and Woods Hole, and also adds to the previously recorded hosts they attack, i.e., *Folliculina ampulla, F. elegans, Cothurnia ingenita*, and *C. socialis*, this folliculinid on *Pagurus pubescens.* Moreover, this same parasite was seen on a few *Parafolliculina amphora* and *Metafolliculina andrewsi* in September, 1941; on the west shore of the Chesapeake Bay, north of Baltimore.

In passing, we note that Chatton and Lwoff previously discovered a flagellated organism, *Sporomonas infusorium*, living as a parasite in *Folliculina elegans*, as well as in *Vorticella*, in the aquaria at Banyuls and in *F. ampulla* from Woods Hole. In the folliculinid this *Sporomonas infusorium* grows to be a mass of 70μ diameter before it escapes from the folliculinid to sporulate inside the test.

The folliculinid these authors call *F. ampulla* is a multinucleate form with long spirally reinforced neck and may well be what Hadzi later called *Metafolliculina andrewsi.*

Whether *Platyfolliculina paguri* occurs also in other habitats remains to be found out. It is not the only folliculinid in this habitat, for on one specimen of *Pagurus pubescens* there were found two long, slender folliculinids of some other kind. One was fast to the right side of the fourth segment of the hind body, pointing downward, and the other was well protected on the chela closely surrounded by heavy conical spines. These two seem to represent some undescribed form.

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ZOOLOGY.—*On a species of pycnogonid from the North Pacific.*[1] JOEL W. HEDGPETH. (Communicated by CLARENCE R. SHOEMAKER.)

The species of pycnogonid here described is based on specimens named and designated as types by the late Dr. Louis Giltay, and deposited as such in the United States National Museum. After this paper was submitted for printing, Dr. William A. Hilton published preliminary diagnoses of some new species in *Colossendeis*, the genus concerned, including one under the same name.[2] Although the diagnosis is vague, and incorrect in one detail ("ocular tubercle . . . not pointed," p. 3), the specimens consulted undoubtedly are the same species and were evidently labeled by Dr. Giltay. As it may be many years before descriptions and figures of these numerous preliminary species are published, I have deemed it wise to proceed with this paper in order to clarify the status of at least one of these species. Inasmuch as all the material examined appears to have been labeled by Dr. Giltay, his type designation, supported by the description and figure herein, should not be abandoned in favor of that in a brief diagnosis. Although it is impossible, of course, to credit Dr. Giltay with the authorship of this species, it is unfortunate that his label name was not acknowledged in the preliminary diagnosis. The type specimens were taken by the U. S. Bureau of Fisheries steamer *Albatross*.

Genus **Colossendeis** Jarschinsky
Colossendeis tenera Hilton[2]

Holotype.—Male; *Albatross* station 3346, 44°31′ N., 124°52′ W., 786 fathoms, September 22, 1890.

Paratypes.—Male; *Albatross* station 3074, 47°22′00″ N., 125°48′30″ W., 877 fathoms, June 29, 1889. Three females; *Albatross* station 2859, 55°20′ N., 136°20′ W., 1,569 fathoms, August 29, 1888.

Description.—Trunk slender, unsegmented, lateral processes separated by spaces somewhat narrower than their own diameter, except the posterior pair, which appears to be more widely separated than the preceding pairs. The eye tubercle is very high, narrowly conical, and tapers to a small blunt point. The eyes are basal, large, but indistinctly pigmented. The anterior pair is larger than the posterior.

Proboscis slender, straight, slightly dilated near the distal third and slightly expanded at the tip. It is markedly longer than the trunk.

Palpus covered with minute setae, especially the distal joints. Basal joint much broader than long; second joint straight, sticklike; third joint not much longer than wide, slightly curved; fourth joint little more than half as long as second; fifth joint shorter than sixth; seventh shorter than wide; eighth about three times as long as seventh; ninth joint slightly longer than eighth.

Abdomen papilliform, directed upward at an angle and longer than the last lateral processes.

Oviger: First and second joints subequal; third joint about half again as long as first; fourth and sixth long, nearly straight, subequal, or sixth slightly longer than fourth in the male; fifth joint about half as long as fourth. Terminal segments diminishing in length distally, with 7 to 10 flat, finely denticulated spines in the largest rows. Terminal claw heavy, curved, about four times as long as basal width.

Third leg: Coxae subequal. Femur slightly

[1] Received March 30, 1943.

[2] HILTON, W. A. *Pycnogonids from the Pacific.* Pomona Journ. Ent. and Zool. **35** (1): 2–4. 1943.

longer than first tibia, which is slightly longer than the second tibia. Tarsus longer than propodus, terminal claw longer than propodus but not as long as tarsus. The legs are straight, slender, and without marked swellings or protuberances.

Remarks.—This species resembles *Colossendeis angusta* in size and general appearance, but it can readily be separated from that species by its much longer proboscis. The eye tubercle is much higher (although in most specimens this is the first part to be damaged) and eyes are present. It is also similar to *Colossendeis megalonyx* but differs from both *C. megalonyx* and *C. angusta* in the character of the denticulate spines on the oviger. *Colossendeis tenera* appears to be a North Pacific basin species; all known localities are off the northwestern United States.

MEASUREMENTS

	Paratype, ♂	*Paratype*, ♀
Proboscis	8.5 mm	9.75 mm
Trunk	6.5	7.0
Cephalic segment	1.8	1.9
Width, second lateral process	3.0	3.0
Abdomen	0.8	1.0
Eye tubercle	x (tip broken)	2.0
Third leg:		
First coxa	1.0	1.0
Second coxa	1.5	1.25
Third coxa	1.5	1.5
Femur	18.0	20.0
First tibia	15.0	17.0
Second tibia	11.0	11.5
Tarsus	4.75	4.0
Propodus	3.5	3.0
Terminal claw	4.0	3.75
Oviger:		
Basal joints	1.5	1.4
Fourth joint	8.0	9.0
Fifth joint	3.0	4.0
Sixth joint	9.0	9.0

Terminal joints coiled, not measured.

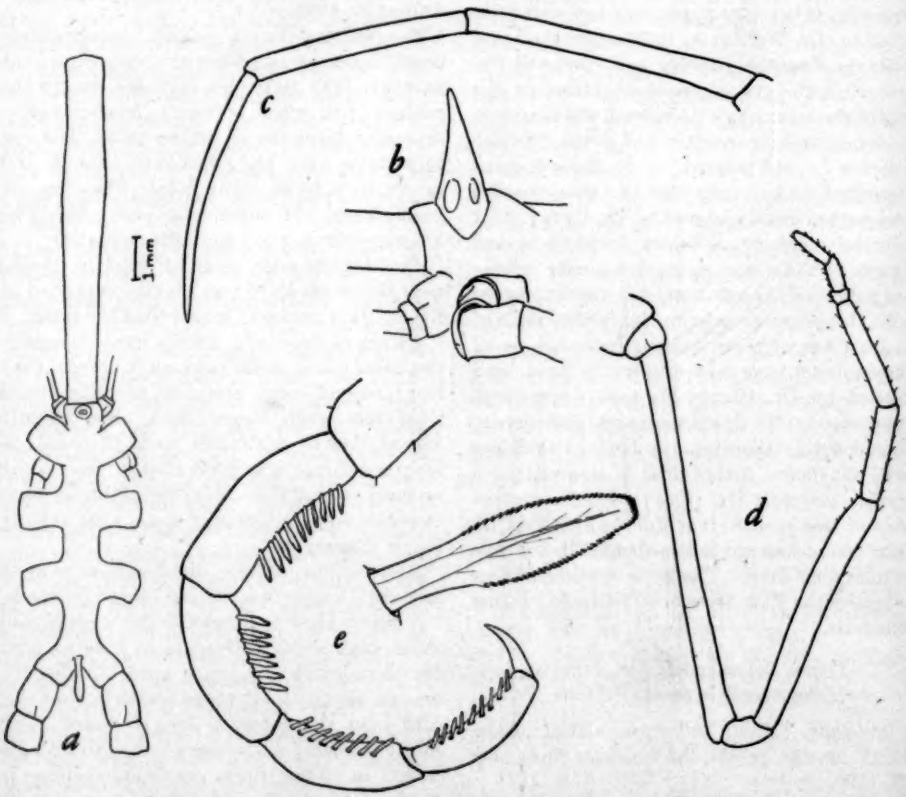

Fig. 1.—*Colossendeis tenera* Hilton, drawn from paratypes in the U. S. National Museum: *a*, Dorsal view of paratype, ♂; *b*, sketch of cephalic region of paratype; *c*, terminal joints of leg of paratype, ♀; *d*, palpus of paratype, ♀; *e*, terminal joints of oviger of paratype, ♂, with denticulate spine from seventh segment.

All drawings except *b* and denticulate spine made with the aid of a camera lucida.